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PELLAGRA AND PELLAGRA-LIKE CONDITIONS IN WARM CLIMATES.

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Section II.*

In the section which will follow it is proposed to discuss a number of conditions, having many features in common with pellagra, which have been the subject of communications, some in recent years, others many decades ago. To some of these, as possible examples of atypical pellagra, attention has been called on a previous occasion (H. S. Stannus, 1930). In the next section this argument will be pressed further. These several conditions, occurring in native races in different parts of the world, at first sight may appear very varied, though in more recent cases those who have recorded their observations have sought to explain them all on a basis of unbalanced dietaries.

In studying these various communications, in many of which the authors have been at pains to give a differential diagnosis from pellagra, I have been struck by what would appear to be a failure to appreciate many of the facts about that disease. It is given to few medical men to have the opportunity of studying pellagra. The abridged accounts of the disease which appear in text-books are, many of them, based on the observations of the last century, and contain many statements which are calculated to give a wrong impression of the affection, while, at the same time, many facts of importance are omitted. In this section it is, therefore, my intention to discuss the symptomatology of pellagra with a view to clearing up some points about which there has been a good deal of misconception.

H. F. Harris (in 1919) wrote: "It is unquestionably true that the name given to this disease and the striking character of the dermal symptoms have resulted in these manifestations being accorded an undue and wholly unjustifiable prominence in the minds of many who have written on the subject" . . . . "All practical pellagrologists

* Section I appeared in the October issue (pp. 729–741). Section III, with a list of references relating to Section I–III, will appear in the December issue.

from the earliest periods have recognised that the symptomatology of pellagra is not limited to those obvious and very pronounced phenomena which characterise the fully developed disease."

That the disease was a generalized affection was recognized by Cajetani STRAMBIO (1789) when he defined pellagra as "Morbus chronicus totius corporis, cerebri nervorumque functiones potissimum laedens, ut plurimum cum desquamatione dorsi manum, & pedum, aliarumque aevi expositarum partium sive est syndromes eorum, quae retulimus symptomatum, inter quae praecipua, & frequentiora sunt variae affectiones cutaneae, spasmi, dolores, vesaniae."

Pellagra is a disease as A. D. BIGLAND has said (1920) "extremely difficult to diagnose and often overlooked unless the possibility of its occurrence is kept in mind." The diagnosis in most of the cases that are published rests firmly enough upon the presence of that trinity of symptoms "Dermatitis, Diarrhoea and Dementia," but while we may admire the alliterative ability of the author of this diagnostic slogan, it is probably true if it be said that nothing has done more to stifle the recognition of early cases and those that do not manifest what have been called the classical symptoms.

HARRIS believes that in an endemic area possibly the majority of cases of pellagra never develop these classical symptoms of the disease, and in this connexion it is of interest to recall the fact that pellagra without skin lesions was recognized by CASAL and later well known to STRAMBIO who used the term "Pellagra sine pellagra," better rendered perhaps by S. R. ROBERTS (1912) as "Pellagra sine Exanthemata" [*sic*]. A. G. BIGGAM & P. GHALIOUNGUI (1933) have referred to such cases as larval cases and H. S. STANNUS has used the phrase "Pellagra fruste." It may also here be noted that HARRIS thought that the disease tended to be unaccompanied by skin lesions in particular localities, more especially in the tropics. The first point then upon which I want to lay emphasis is that pellagra is a disease which may show great variety in the picture which it presents, variety in the course which the disease takes, variety in the symptomatology, and variety in the intensity of individual symptoms. In any single case or small group of cases any one or more of what have been considered typical symptoms may be absent. G. A. WATSON (1923) face to face for the first time with an outbreak of pellagra among the inmates at Rainhill could not believe that the mild type and severe fulminating cases were one and the same disease.

It must be remembered that at the one extreme is the case which proves fatal in a few weeks or less, and at the other the pellagrin of eighty years of age or more who has suffered from the disease since childhood.

E. RUD (1934) believes that latent pellagra may not be rare and that many cases regarded merely as dyspepsia with anorexia, colitis, neurasthenia, etc., are in reality examples of that disease. With that opinion I am in complete accord.

Among the symptoms which may precede by many years "an attack" of pellagra in which the classical manifestations are seen, or which may never develop any further, are a gradual deterioration of health with some degree of failure of mental and bodily vigour, a tendency to hypochondriasis or mild attacks of mental depression, periodical digestive disturbances with abdominal discomfort and constipation broken by occasional lapses into diarrhoea, a sore mouth, a sore tongue showing scattered enlarged papillae, soreness at the

angles of the mouth and in women leucorrhoea. Other symptoms later may include indefinite pains in the limbs and elsewhere, odd subjective sensations including vertigo, sometimes disturbances of vision and hearing. The skin may show a peculiar dryness with formation of tiny scales, sometimes limited to uncovered areas, sometimes extending over the whole body, and fine wrinkling best seen on the backs of the hands and over the interphalangeal joints.

Of the objective signs the peculiar soreness at the angles of the mouth, which I shall speak of as "angular stomatitis," is one of the most characteristic, as was pointed out by H. S. STANNUS (1913). When once recognized it cannot be mistaken, I think, with one possible exception, for any other condition. This condition, together with a marginal glossitis are perhaps among the earliest signs and may anticipate more active symptoms by many years.

They were noted by a few of the older pellagrologists, ZANETTI, STRAMBIO and others, and they have received recognition again in more recent times. Thus A. FAKHRY (1932) believes stomatitis to be a common early symptom of pellagra. HARRIS and ROBERTS recognized the pre-pellagrous state. Angular stomatitis has been, of course, noted among native races in the tropics for many years and described as an isolated sign: it has been observed in Africa and in the East, where it has been attributed to the eating of salt fish. The association may be correct but I do not think it is merely a local reaction as has been suggested. More recently it has been considered to be a sign of an A-avitaminosis, and W. R. AYKROYD writing from the Nutritional Research Laboratories, Coonoor, enclosing a photograph of an Indian girl showing very beautifully this condition, says that it is not uncommon and is closely associated with xerophthalmia, both being due, he thinks, to a vitamin A deficiency. Be that as it may, angular stomatitis should be looked upon probably as a prepellagrous sign. This question will be discussed later.

D. T. DAVIES (1931) and others have remarked a condition closely resembling, if not identical with, angular stomatitis in cases of achlorhydric anaemia in this country, a point also to be referred to later. H. J. ROPER of Leeds (1931) referring to DAVIES' observations stated that he had noticed the condition for many years and believed it to be due to injury in inserting and removing large dentures. This is only mentioned here in order to point out that Roper must be referring to some other condition. "Angular stomatitis" does not occur among the ordinary normal adult population of this country. I have looked over many thousands of persons in London without noting the affection.

The early glossitis consists generally in a moist, furred tongue with reddened edges, and scattered brilliantly reddened hypertrophic papillae. Associated with these there may be similar affections of the free margin of the prepuce, of the vulva and vagina, the margin of the anus and perineum.

Attention was drawn to these lesions by STANNUS as valuable signs in diagnosis, both in the prepellagrous stage and in the full-blown disease when the skin about the inner and external canthi and nostrils may also be affected. These conditions are well known to many pellagrologists but not always recorded and perhaps by some missed because they are not looked for.

Turning now to a consideration of the symptoms of pellagra as they are commonly presented in text-books and as they are commonly

conceived in the minds of perhaps the majority of medical men, and dealing firstly with the dermal manifestations—" each spring (or sometimes in the autumn) an acute dermatitis appears on exposed surfaces as the result of the sun's radiations acting on the skin rendered photo-sensitive by some substance developed in pellagra, to disappear again in the autumn "—is the kind of statement generally made and believed.

"Supprimez le soleil et vous supprimerez la pellagre" said LANDOUZY & BOUCHARD in the *Dictionnaire Dechambre.*

STRAMBIO (1789) when he wrote " Ergo desqamatio non est vi solis proportionalis. Ergo causae non correspondent effectus, ideo que praeter solis actionem aliud quid requiriter, interior scilicet morbosa humorium dyscrasia " recognized that something more than the sun's rays was necessary to explain the skin affection, but more important still, he realized that the erythema was not proportional to the exposure to sunshine, yet the doctrine of sunshine and erythema as cause and effect was one strenuously upheld by SANDWITH and others and persists to this day in spite of abundant evidence to the contrary. The typical distribution of the exanthem on the backs of the hands, cheeks and nose (the " butterfly " area), neck and chest, etc., were held to prove this belief. SANDWITH believed that the terminal phalanges of the fingers escaped because they were hidden from the sun and that when the dorsa of the feet were involved, the area covered by the sandal remained normal. C. MANTHOS (1932) pointed to the fact that in veiled women in Turkey the face was exempt. The case is also cited of the opposite—a man who habitually walked with his hands behind his back, palms upwards, developed an erythema of the palms. The facts are correct as far as they go but, as I shall try to show in a later section, there may be other explanations.

The explanation usually given fails to account for those cases in which the exanthem develops in the winter ; for the fact that it is in the spring rather than the summer, when the sun's rays are most powerful, that the erythema appears, as pointed out by T. D. SPIES (1935) ; for the fact that the rash may appear in its typical distribution in patients who have been confined to bed for some time, and conversely, may be found in these same selected areas in persons whose whole body is exposed to the sun, as observed by E. NEUSSER (1887) ; for the case of G. A. ZELLER cited by J. N. HYDE (1910), a woman in whom the exanthem failed to appear on a paralysed hand although equally exposed to the sun's rays as the other hand on which the rash occurred, and a similar case recorded by S. R. ROBERTS (1929), etc. T. D. SPIES (1935) has only recently alluded to the erroneous views still held by many writers upon this question. They ignore the fact that the pellagrous exanthem may affect any and every part of the skin of the unexposed surface of the body as stated by E. J. WOOD (1920). They have forgotten that the palms of the hands and soles of the feet may be affected. They have ignored the fact that in cases exhibiting the classical distribution the exanthem typically encircles the wrist, bracelet fashion. To those who have studied pellagra closely it has become obvious that there is a tendency for the exanthem to occur in any area of the skin open to trauma of any kind, using the word in its widest sense.

C. C. BASS (1926 and 1929) has cited cases in which points of pressure were affected, the buttocks and elbows in bedridden patients, the heels and shoulders also in others, the knees in a woman given to long

prayer. The skin over the course of prominent veins liable to friction by clothing may be similarly attacked. Constant exposure to the heat of a fire will determine the appearance of the pellagraderm, as will exposure to X-rays or irritation by a chemical such as carbolic acid, ichthyol, a mustard leaf, etc. Areas of skin liable to intertrigo may similarly be involved—under the breast, as pointed out by C. C. BASS (1929), the gluteal fold mentioned by S. R. ROBERTS (1929), the groins and perineum. The lesions in these latter situations resemble, only naturally, those already described as occurring about the lips, nostrils and vulva. The particular character of the lesions depends upon the histological make-up of the skin to a large extent, a point to which I think attention has, in so many words, never before been drawn. This is particularly true of the skin of the scrotum which when affected is a sign of great diagnostic value, particularly as this lesion may be seen when perhaps there is little evidence of pellagra present and no typical exanthem.

It is a sign which appears to be but seldom recorded and one which, it seems possible, is not looked for and, therefore, passed over. The condition was discovered in 19 of the 131 cases investigated by STANNUS and in 4 of the 19 there was no pellagrous exanthem.

L. MERK (1911) acknowledges the condition as a sign of pellagra and it is also recognized by HARRIS (1919), G. A. WHEELER (1930) and by SPIES. A. D. BIGLAND (1920) met with one case among his 64 Turkish prisoner pellagrins and the affection was noted by MENDELSON in Siam (1919, 1923) and by CANTOR (1927) in a case in Melbourne. It is also of interest to recall the fact that this was the condition which first appeared in the convicts subjected to an experimental pellagra-producing diet by GOLDBERGER (1915), one upon which the diagnosis of pellagra was based. Reference will be made to this affection later when discussing the condition described by LANDOR & PALLISTER.

Another site which may be attacked, although often forgotten, is the nailbed, resulting, as in the skin, in pigmentation and deformation of the nails of the fingers and toes. A. G. BIGGAM & P. GHALIOUNGUI (1933) have shown that desquamation in the interdigital clefts is very suggestive. The hair may be thinned and there may be some loss of pigment.

In regard to the typical exanthem itself there are a few points which need emphasis as they appear to be not generally recognized. Usually it is of sudden onset and runs a course of some weeks or months—erythema, hyperkeratosis, pigmentation, exfoliation, to healing. In some cases the erythema may be slight and so evanescent as to pass unnoticed. In others the lesion is a severe one. Bullae may develop with ulceration and sometimes ecchymosis ; a permanently altered skin may result.

The severity of the skin lesions bears little relation to the severity of the other symptoms ; a patient may die of acute pellagra before skin lesions have become evident. Here attention may be called to another matter which has received very little recognition, and appears not to be generally known. Some twenty-five years ago I observed among native African pellagrins that whereas during " the attack " successive areas of skin might become involved rapidly one after the other, after the attack, which lasted a few weeks, no further skin lesions appeared although the patients remained under the same conditions of diet and exposure, and without treatment. The point was even better exemplified in an English child pellagrin (H. S. STANNUS

1934); the skin lesions began to heal during a period of observation when the patient was intensely ill, and before treatment had been instituted. Later various exposures to bright sunlight failed to produce any other reactions than those produced in controls. C. C. BASS (1926) had noted what he called the loss of power of epiblastic epithelium to withstand noxious stimuli and that this lasted but a short time, viz., during the active phase.

T. D. SPIES (1931) has called attention to this point: Three white males and one negress kept on a pellagra-producing diet of corn-meal mush, corn-meal muffins, pork fat, maple syrup, polished rice, corn-starch pudding, coffee and sugar, showed striking improvement. It was thought that the improvement might have been due to the exclusion of alcohol, but the following year this observer (1932) demonstrated that improvement in the skin lesions occurred in eight pellagrins during 6–15 days upon corn-starch and lactose though the stomatitis was adversely affected, and again (1932) that the symptoms cleared up in pellagrins while fed over twenty days with an experimental diet more restricted than that used by GOLDBERGER in producing pellagra in his convicts. T. D. SPIES & H. F. DEWOLF (1933) also showed that in ten pellagrins recovery took place when they were given an adequate diet, together with a large quantity of corn whiskey. Further observations by SPIES (1935) are of interest. Recently by experiment he has shown that exposures of areas of pellagrous dermatitis to large doses of U-V radiation or to direct sunlight do not prevent healing of the lesions even while the patient is limited to a pellagra-producing diet, but he adds that it is difficult to gauge the effect of such experiments as the pellagrous rash itself is never static—it is either getting worse or getting better. He alludes, of course, here to the acute erythema. The experimental work of GOUGEROT & J. MEYER (1932) was without very definite results, but the fact emerges from these observations—one that I would again emphasize—the "susceptibility," one may call it, to the acute exanthem lasts but a short period of time and is followed by a long "refractory" period. Concerning the explanation of these phenomena I shall have more to say elsewhere. They have received but little recognition, and no attempt has been made to interpret them. A. D. BIGLAND (1920) says "I was never able to make any skin changes appear at will . . . . I cannot account for this failure."

It will be noted what an important bearing, therefore, the above mentioned facts have on the evaluation of treatment.

One other point: although in classical pellagra "the attack" may be expected to recur once a year in the spring up to ten years or more, it must not be forgotten that the interval between attacks may extend to as many years.

Not uncommon, but apparently seldom recognized or seldom recorded, are other affections of the skin known to the older writers STRAMBIO, MAJOCCHI, and others, as seborrhoeic, acneiform, follicular and kerato-follicular, pellagraderms. Accounts of these conditions will also be found in the writings of some later pellagrologists—C. C. BASS (1926), S. R. ROBERTS (1929), HARRIS (1919).

They may be present during the acute phases but are often seen in chronic pellagra and are of considerable value in diagnosis. The seborrhoeiform eruption is usually seen on the face, nose, cheeks and forehead, sometimes on the chest or still more widely distributed; it gives rise to the appearance which has been called "sulphur flake."

The acneiform condition similarly is found about the nose, on the cheeks, forehead, chin, chest and back, comedo formation being more or less marked. A. D. BIGLAND (1920) notes this peculiar seborrhoeic condition on the face with formation of " sulphur granules " and the branny desquamation over the whole body in some of the Turkish war prisoners ; H. KLEINMANN (1931) found what he called hyperkeratosis about the nose in 14 of 63 pellagrins studied in Moldavia, and these conditions were common among African pellagrins observed by STANNUS in 1910–11.

The kerato-follicular lesions of MAJOCCHI are equally interesting. They were described by STANNUS as a folliculitis, and it may be observed that T. E. H. THAYSEN (1932) has remarked the condition in pellagra occurring in Denmark. It was also noted by YANG & HUANG (1934) in cases of pellagra seen at Nanking. These lesions of the pilo-sebaceous glands vary a little in character, some being of the Keratosis pilaris type, others resemble Lichen spinulosus, others again have somewhat the appearance of Pityriasis rubra pilaris. The distribution is rather characteristic—extensor aspects of the arms, the anterior and lateral surfaces of the thighs, the buttocks, and may be the back and chest. They need not be described in more detail ; they are easily recognized. These conditions will be referred to again when discussing communications by L. J. A. LOEWENTHAL and by L. NICHOLLS. Two skin conditions of importance in attempting a diagnosis between " attacks " or in some of those cases in which the attack is not apparent may briefly be referred to here. The one is a characteristic persistent increase in the wrinkling of the skin over the proximal interphalangeal joints with slight thickening and change in texture, and a peculiar lilac colouration. The second is the appearance most commonly seen in the skin of the shins, which looks as if a smooth layer of lacquer had been applied and then cracked mosaic-fashion, the colour varying according to race, in the European a transparent yellow, like yellow tracing paper, and proportionately darker in the darker races. This is probably the condition to which STRAMBIO referred as being like " the skin of a duck's foot."

In old pellagrins the dry, smooth, glossy, parchment-like atrophic skin characteristically seen on the backs of the hands needs no comment.

Associated with the skin lesions some oedema is often present, it may be noted in the face giving a " puffy " appearance and is not uncommon in the lower extremities—a fact often forgotten. A. D. BIGLAND (1920) said " from a study of the literature it appears that oedema is a symptom of great rarity." He found only one reference, that by KULZ. As a matter of fact it is not uncommon, as BIGLAND found in his Turkish prisoners of war. It was noted in my African native cases and has been remarked since the time of STRAMBIO.

In summarizing, the point which I wish to make, in regard to the skin lesions, is that essentially they are all of the same order. They vary only according to the intensity, duration and recurrence of the pathological process producing them on the one hand and upon the differences in histological structure of the skin in different parts of the body on the other.

A study of the lesions in mucous membranes will show that the same is true, and further that the affections of the mucous membranes are homologous with those of the skin. This point has not been duly recognized but it is an essential one if we would attempt to understand

the method of production of these conditions, a matter which will be discussed in a subsequent paper.

As in the skin so in the mucous membranes, the reactions seen in pellagra vary in intensity and vary somewhat according to site. Those that are open to inspection have been described, those that cannot be viewed have been inferred. Beginning with the conjunctiva and cornea, as more nearly allied to the skin, in early stages redness and lacrymation with epiphora may be observed. Xerosis has been described from early times, phlyctenular ulceration and keratomalacia may occur in some proportion of cases. The nasal mucosa is involved causing coryza and sneezing. The varied but characteristic, well known changes in the tongue—congestion, exfoliation, etc., are the counterpart of those in the skin. The same is true of the mucous membrane of the mouth, pharynx, oesophagus and larynx. The gums are similarly affected and exfoliation at this site and on the cheeks may give rise to the formation of a pellicle, but true ulceration here, as in the skin, is probably rare in pellagra. It is sometimes said that " the gums are swollen and bleed easily " and that this gave rise to the name Alpine Scurvy used by ODOARDI. I believe this to be not quite correct ; the mucous membrane of the gums is congested and may bleed on injury, gingivitis may be present because the gums are not cleansed properly, but the condition present is not in my opinion the same as in scurvy.

In dark-skinned races among whom there is commonly some pigmentation of the mucosa of the mouth, tongue and gums, the pigmentation may be increased. A blue lividity on the inner surfaces of the cheeks and areas of dark pigmentation on the tongue and gums may be then conspicuous.

Salivation corresponding to epiphora and nasal discharge is not uncommon. Vaginitis, proctitis, possibly urethritis, are of similar nature. The characteristic watery diarrhoea suggests that the intestinal tract is in the same way affected. It is interesting to note that in the earlier cases the diarrhoea comes in attacks rather as does the erythema of the skin. Here, again, I believe that probably ulceration of the bowel, though it has often been described as such, is no part of true pellagra but a secondary phenomenon.

These various conditions will not be further discussed, but it must be noted that any one or more of them may be absent in any single case or group of cases. A case of classical pellagra may come to be a fatal issue with a normal mouth.

The incidence of some of these lesions may here receive a brief notice. E. WEISS collected statistics in an endemic area in the Tyrol between 1905 and 1907. There were 8,436 cases of pellagra in a total population of 384,073. Of the pellagrins 61·4 per cent. exhibited skin lesions, of an erythematous character in nearly half. Of these last the dermatitis affected the backs of the hands in 77 per cent. ; hands and neck in 13 per cent. ; neck and other parts 7·5 per cent. ; other parts 2·4 per cent.

Among STANNUS' native African prisoners, of a total of 131, 97 showed the exanthem. Of those with exanthem, in 30 it was limited to the backs of the hands, wrists, forearms and arms ; in 29 the supraclavicular regions were affected as well ; in 19 all these areas were involved together with the neck ; the face was also affected in 12 more ; in 6 some part of the legs and body were also included ; in one the whole body was involved.

Of the 97 cases exhibiting the exanthem, 26 showed a normal oral cavity ; in 26 angular stomatitis was present with or without glossitis ; in 9 the tongue was involved but not the lips. In 5 there was a generalized acute stomatitis. The scrotum was attacked in 19. Soreness at the canthi, nostrils, preputial margin and anus was not uncommon.

Affections of the vulva and vagina were considered to be common in women pellagrins by the Illinois Pellagra Commission (1912).

E. D. CRUTCHFIELD (1928) found among 109 cases studied at Galveston, Texas, that 64·57 per cent. showed lesions of mucous membranes. Glossitis was the most common ; stomatitis was noted in 21·27 per cent., gingivitis in 16·14, vulvo-vaginitis in 12·1, proctitis in 10·09 per cent.

L. MERK (1909) on the other hand mentions that in twelve months in the Tyrol he did not see a couple of cases exhibiting buccal or genital lesions !

T. R. BOGGS & P. PADGET (1932) among 102 cases of sporadic pellagra in Baltimore, of whom 44 per cent. were admitted to hospital on account of the skin lesions (though all had typical skin lesions), found that the backs of the hands were affected in 100 per cent., face and neck in 23·5, elbows 12·7, feet 8·8, perineum in 23 ; 74·5 per cent. showed stomatitis.

R. H. TURNER (1931) discovered glossitis in 26 of 42 pellagrins under observation in New Orleans. A. G. BIGGAM & P. GHALIOUNGUI (1933) in Cairo observed the buccal cavity involved in 24 of 26 cases of pellagra.

Changes in the finger-nails are common according to ANTONINI (1902). ALPAGO-NOVELLO (1894) held that demonstrable changes in the finger-nails were present in 94 per cent. of pellagrins. E. VERGA (1915) found marked changes in the finger-nails in 4 per cent. and in the toe-nails in 2 per cent. ; less marked changes in 10 and 12 per cent.

It is not proposed here to say much about the other sides of the symptomatology of pellagra but a few observations upon points which I believe up to date have been wrongly interpreted, may be made.

One of the most constant subjective symptoms in pellagra is " burning pain " and tingling, sometimes limited to " burning pains " in the palms of the hands and soles of the feet, sometimes also experienced in areas of skin upon which the erythema will appear, in a few in the scalp or the whole body. The burning pains and tingling of the palms and soles are unquestionably of the same nature as those felt elsewhere in the skin and, I believe, exactly comparable with those in mucous surfaces, in the mouth, tongue, cheeks, and pharynx. These sensations are often referred to, together with other symptoms, as if they were signs of a neuritis. By A. G. BIGGAM & P. GHALIOUNGUI (1933) they are mentioned as nervous manifestations. I believe this not to be true as I shall hope to show when dealing with pathogenesis elsewhere. These " burning pains " are almost pathognomonic of pellagra, though something of the kind may be found in acromegaly, at the menopause, possibly in ergotism and the epidemic acrodynia of the first half of the 19th century in France, and has been stated to occur in the dry form of beriberi associated with a scaly skin. (!)

Gastro-intestinal symptoms will also be referred to elsewhere, digestive disturbances, consisting of discomfort after meals, a feeling of fullness, wind, burning sensation, pyrosis, etc., are present in the majority of cases.

Symptoms pointing to changes in the central nervous system and mental manifestations likewise will not here be dealt with except to remark that many of them in acute pellagra are due to derangements of function and that they may vary in a very short time, in a matter of days, well shown in a case under my own care, H. S. STANNUS & C. R. GIBSON (1934). In regard to mental disease it is not always made clear that the association of a psychosis with pellagra is twofold: there is the mental derangement which occurs as a result of pellagra—which forms part of the disease, and secondly pellagra is prone to occur in the insane. The reasons for this will be suggested elsewhere when dealing with the aetiology of the disease. This distinction is seldom pointed out but it is a very important one. The changes in the blood will also be discussed elsewhere.

Pellagra in children may here receive a word of comment. It has been thought to be a rare affection in children by some, to quote only one recent writer, Miss C. WILLIAMS (1933).

J. GOLDBERGER & G. A. WHEELER (1928) during field investigations in S. Carolina demonstrated a preponderance of pellagra incidence in children between the ages of 2 and 15 years. A. FAKHRY (1932) found male children under the age of 12 to be particularly susceptible in Egypt, an interesting observation in view of the fact that SANDWITH thought pellagra was rare under the age of 10, and the statement that he had never seen a case under the age of 15 years. Many of SANDWITH's observations, however, have been proved to need modification, and L. SAMBON (1910) commenting upon the matter pointed out that the erythema in children is often so mild and evanescent that it may escape observation. SAMBON mentions cases in infants, the youngest being 5 months old. He believed that the "incubation period," as he called it, might be as short as three weeks.

S. R. LUSTBERG & J. A. K. BIRCHETT, Junr. (1922) have contributed interesting observations upon pellagra in 5 to 10 months old breast-fed children of pellagrous mothers. The mother develops pellagra during the three winter months on a diet of dried peas and beans, musty corn-meal, sugar, molasses, salt hog meat, rice, coffee, canned milk, and lard. The infant is frail, restless, suffers from bouts of diarrhoea, a sore mouth, and develops the exanthem, may be on hands and feet. The cases are mild and respond to healthy wet nurse feeding or a diet of good milk, fruit juice and vegetable purée.

E. LEWIS (1926) has given a full account of pellagra in a coloured infant of 17 months of age which will serve as a good illustrative case.

Loss of weight noticed on September 1. On November 1 eruption noted behind knees. There were four loose, foul smelling stools per day. The child was apathetic but fretful, emaciation more marked, both feet oedematous. Pigmented areas then appeared behind the left ear, and on the forehead; the skin of the chin, chest and shoulders became dry and scaly; the exanthem with desquamation then noted on the backs of the hands and wrists and right forearm, the dorsum of the penis, scrotum, perineum, the inner and outer sides of the thigh, the popliteal space and calf, the right buttock and lumbar region; the dorsa of the feet exhibited lightly pigmented areas, the toes were purplish in colour, there was desquamation of the soles of the feet. Angular stomatitis was present, the gums were inflamed and the mucous membrane of the right side of the mouth congested. The child recovered on being given yeast, beef, and codliver oil.

LAVINDER has seen pellagra in nurslings; he thinks the tongue is often affected before other symptoms appear, then the gums, followed

by gastro-intestinal derangement, and lastly the exanthem with pain in limbs about the joints.

D. L. SMITH considers that the earliest manifestations in infants are on the nervous side, then diarrhoea, sore mouth and later the rash which is more commonly noted in the pubic region, on the neck and forehead, more rarely on the backs of the hands and feet. Probably many die of diarrhoea before the diagnosis is made.

C. J. BLOOM (1928) writing upon the subject says: "The infrequency of pellagra in infancy and childhood is without proof or substantiation." From his figures for annual numbers of deaths in children from pellagra there would appear to be more deaths in the first five years of life than in the second or third 5-year periods in the proportions 458 : 424 : 383.

These are, of course, cases of pellagra fully diagnosed; it seems very possible that many milder cases go undiagnosed in young children.

THE NATIVE MEDICAL PRACTITIONER IN THE WESTERN PACIFIC AND THE CENTRAL MEDICAL SCHOOL IN SUVA, FIJI.

By Thomas CLUNIE, M.B., Ch.B., *Medical Superintendent Colonial War Memorial Hospital, Suva,*

and

V. W. T. McGUSTY, M.B., *Late Inspecting Medical Officer, Fiji.*

General Remarks.—Great Britain, France and the United States of America, with respect to the health of their native peoples in certain of their Colonial possessions in the islands of the Southern Pacific Ocean, are participants in a scheme under which native youths are sent to a Central Medical School at Suva in the Colony of Fiji, whence, after a four years' course of studentship, they are returned with the diploma of Native Medical Practitioner to serve under their respective administrations.

The participating administrations.—Those of the administrations participating in the scheme which are British owned fall within the following classes :—

(*a*) All territories administered by the Governor of Fiji as Governor and High Commissioner of the Western Pacific, which include the colonies of Fiji and the Gilbert and Ellice Islands ; the British Solomon Islands Protectorate ; the native Kingdom of Tonga, and the Condominium of the New Hebrides in which France is the other partner.

(*b*) All the tropical island territories which are administered by the Government of New Zealand comprising the Cook Islands, Niue, the Mandated Territory of Western Samoa and the Tokelau Islands.

(*c*) The phosphate producing island of Nauru, which is administered under mandate by the Commonwealth Government of Australia.

The United States Government is interested with respect to the Territory of Eastern Samoa where the Navy Department has established an efficient health service, and the introduction of the Native Medical Practitioner may only be experimental. France's participation is limited to her interests in the New Hebrides Condominium.

The native peoples of the Southern Pacific.—The administrations participating in the Native Medical Practitioner Scheme contain representatives of each of the three main subdivisions of the Pacific Islanders, namely Polynesians, Micronesians and Melanesians ; and while there exist as between Polynesian and Micronesian on the one hand and Melanesian, on the other, marked differences both in physical characteristics and mental capacity, all of the three peoples, prior to European intervention, were in the Neolithic stage of civilization. Similarities in diet and climate, and the diffusion of culture which resulted from the great Polynesian migrations that are said to have taken place in spite of primitive craft and vast ocean distances, have tended further towards the creation of affinities and the obliteration of differences in the form of their social systems. Since the communal form of society is found to be universal in its distribution, it is a factor of great importance in framing a government suited to the character and requirements of the Pacific islanders, and the ultimate success of

any public health undertaking depends on the extent to which it can be moulded into the framework of their society. In the realm of disease, affinities are taken a step further because, with the exception of malaria, which is confined to the New Hebrides and Solomon Islands, identical problems arise everywhere as regards both indigenous diseases and those which have been introduced with European colonization.

The estimated population at the 31st December, 1931, in each of the administrative units was as follows :—

Fiji	185,573
Gilbert and Ellice Islands Colony ...	33,699
British Solomon Islands Protectorate ...	94,000
Kingdom of Tonga	28,830
Western Samoa	47,000
Cook Islands	11,500
Niue	3,834
New Hebrides	50,000–60,000
Eastern Samoa	10,184

All of these places are intimately concerned with the problem of depopulation, which has been solved in Fiji largely through the agency of the Native Medical Practitioner, and which is now being hopefully attacked on similar lines in the other places.

The Native Medical Practitioner in Fiji.—The native Kingdom of Fiji was formally annexed to Great Britain at the request of its chiefs and people on the 10th October, 1874. A medical service was afterwards inaugurated and in the first Colonial Estimates prepared for the year 1875 provision was made for the salaries of a Chief Medical Officer and one District Medical Officer. In June 1888 an Ordinance entitled the Native Medical Practitioners' Ordinance was passed by the Legislative Council in preparation for the issue of their certificates in January, 1889, to the first eight Fijians to qualify as Native Medical Practitioners. The credit for the introduction of this service must be given to Dr. B. Glanville CORNEY, an early Chief Medical Officer, whose work in this and other directions has been an inspiration to his successors. He saw the urgent need for some organization that could rapidly, economically and effectively break down the barriers of prejudice and superstition. He recognized the prohibitive cost of maintaining an adequate service of European Medical Officers, and the insuperable difficulty of finding a group of professional men psychologically and physically fitted to deal with such a situation. Experience of the devastating effects of the measles epidemic of 1875 and the advent of Indian immigration had drawn attention to the necessity to protect the natives against smallpox. European vaccinators were tried but they proved too costly and were not invariably satisfactory. Young natives had already been tried as dressers and dispensary assistants and it was decided to entrust them with the greater responsibilities of public vaccinators. Their success in this capacity seems to have led to the establishment of the Native Medical Practitioner, and the institution of the Native Medical Practitioner may thus have been largely due to the necessity to make vaccination less costly.

Once it was created there was no difficulty in fitting the new service into the organization of the medical department of Fiji, under which the Colony is subdivided into medical districts, to which European

Medical Officers are posted as far as possible. With the advent of the Native Medical Practitioner the main districts, in proportion to their size and population, were divided into subdistricts to which Native Medical Practitioners were posted, and made responsible under the District Medical Officers for the health of the natives. The popularity which the service gained from its inception, the recruitment of its personnel from among the most influential native families, its cheapness and the ease with which it fits into the native social organization have been outstanding factors in promoting its success in Fiji. It has also been found that in most instances Native Medical Practitioners bear the strain of responsibility surprisingly well, and this attribute is enabling the Government to withdraw European Medical Officers from several districts and to adopt a Colony-wide policy of concentrating on hospital and public health services. In the changing conditions of Fiji it has become necessary in some instances to extend the duties of Native Medical Practitioners from the purely native to the general community; nevertheless, the essentially native character of the service has been maintained under a system of rigid Government control which discourages Native Medical Practitioners from obtaining employment in a private capacity.

The success of the Native Medical Practitioner service is dependent on its low cost and the retention by its members of their native character. Any tendency to regard it as other than a subordinate service would be liable to upset the delicate social and economical balance on which its success depends.

In computing the value of the salaries of Native Medical Practitioners it is necessary to take account of the benefits that accrue to them as members of the native communal society in the form of service, food and gifts, and taking all the circumstances into consideration their salaries are maintained at a level which is commensurate with the dignity of their position, and they secure as well the advantages of Civil Servants with respect to pension.

As regards their number the Native Medical Practitioners in the Fiji Service were for many years restricted to twenty, but the expansion that has taken place under the influence of improved training facilities has brought about the steady increase in the personnel which is illustrated in the following table :—

Number of appointments	*Year*
10	1890
17	1900
33	1910
39	1920
51	1930
59	1935

The Indian Medical Practitioner.—It was thought on account of the success of the Native Medical Practitioner Service as a means to contend with the native health problem, that a similar system might be introduced for the benefit of the growing Indian population of Fiji. The Central Medical School was accordingly opened to Indian students, and the first of these to qualify received his certificate in December, 1925. Practical experience has shown that a system which could advantageously be moulded into the social system of the communally living natives, could not confer equal benefits upon the individualistic Indian community, and under the present circumstances the Indian

branch of the Service cannot advisedly be expanded beyond a limited number of appointments to hospitals and dispensaries in Indian districts, with the addition, possibly, of one or two travelling appointments. The certificate of the Central Medical School, except in Government appointments, does not entitle Indian graduates to practise, and in all the circumstances it is desirable that this limitation should stand.

The Native Medical Practitioner outside Fiji.—Prior to the introduction of the present scheme for training natives from the different administrations at the Central Medical School, only two Native Medical Practitioners had been employed in a permanent capacity outside the Colony. One of them, Sowani Puaman, qualified in 1899, and in 1905 he was transferred to the Gilbert and Ellice Islands Colony. He quickly proved his worth as administrator as well as doctor and in 1918 he was put in charge of the Medical Department of the Gilbert and Ellice Islands Colony. Prior to his secondment to Fiji in 1935 he was awarded the distinction of the Order of M.B.E.

The other was Wilisoni Lagi, and he with the permission of the Fiji Government did valuable work in New Guinea as a medical missionary under the auspices of the Methodist Mission Society. These two are isolated instances and the extension of the Native Medical Practitioner, as an actual service, beyond the confines of the Colony of Fiji was a direct result of the post war campaign work in the Western Pacific of the International Health Division of the Rockefeller Foundation, and of the realization by the Foundation's officers that the ultimate success of their work was dependent on the establishment within each administration of a permanent health organization. They also realized that such a service must combine the advantages of low cost and adaptability to native conditions, and they found the solution of their problem in Fiji where, under very similar conditions, the Native Medical Practitioner system had been in successful operation over a period of several decades. Through the very generous financial assistance that was afforded by the Foundation it became possible to extend these benefits to other Pacific administrations.

The Central Medical School.—As a result of the negotiations that were conducted between the Rockefeller Foundation and the Government of Fiji, and of the Foundation's financial assistance, the buildings and equipment of the old Suva Medical School were extended and improved in time for it to be opened in 1928 as the Central Medical School, with 40 students in residence drawn from seven separate administrations. The responsibilities for carrying out all of the local arrangements devolved upon Dr. Aubrey MONTAGUE, the late Chief Medical Officer of Fiji. Dr. Victor G. HEISER, late Divisional Director of the International Health Division of the Rockefeller Foundation, was among the first to appreciate the importance of enlarging the Native Medical Practitioner Service, and his advocacy was instrumental in securing the Foundation's approval. The Fiji Government readily consented to make the Native Medical Practitioner available to any other Administrations that desired to enter the scheme.

Evolution of Teaching.—The earliest students, limited in number to eight, learned their profession in the wards of the old Colonial Hospital where they worked as dressers and male nurses, receiving clinical instruction from the Resident Medical Officer, and practical guidance from Miss M. C. ANDERSON, who held the post of Matron with

great distinction for many years. This was the training which produced those pioneers whose work gained for the Native Medical Practitioner the high reputation which he now enjoys. In 1901 the amenities at the school were improved by the addition of a two-storied residence capable of accommodating twelve students, of a special lecture theatre, and of some rudimentary scientific equipment. Theoretical teaching was gradually incorporated into the syllabus, while the practical side of the course has also improved with the steady increase in volume of the work of the Colonial Hospital. In 1923, when the old hospital was replaced by the present substantial Colonial War Memorial Hospital, the Medical School seems to have been overlooked and the students' lectures had at first to be conducted in an ordinary room, but in 1927 the whole scope of the school was enlarged in preparation for its becoming the Central Medical School. Living quarters were extended to accommodate forty students. A new school building was erected of ferro-concrete with a lecture theatre, laboratories, a museum and a library, and equipment was provided to meet the requirements of teaching. At the same time the teaching system was expanded and reorganized ; a full-time tutor was appointed, and lectureships in the subjects of a course that had become very similar to that of an English medical college, were distributed to medical men and others who willingly accepted posts as honorary lecturers. In 1935 a further important advance was made when a Pathological Laboratory was presented by the Rockefeller Foundation, and a highly qualified pathologist was appointed to take charge of it. In 1931 the period of studentship had been increased from three to four years, and since the school is closely affiliated with the hospital, students are given the fullest opportunities to gain practical knowledge by participating in its activities. It can be claimed with full justice that the standard of teaching makes the graduates of the Central Medical School competent to assume, on their own initiative, the ordinary responsibilities of Medical Practitioners and health officers.

English as the medium of instruction.—Since the students are drawn from places where different languages are spoken, English is used as the medium of instruction, and among its other advantages this measure, by requiring a somewhat high standard of school education, tends to raise the intellectual level of the average student. In some Administrations the standard of school education is much lower than that of Fiji, and in the case of the Solomon Islands this defect has necessitated a temporary departure from the important principle of admitting only students of pure native blood as that Administration's quota could only be filled by admitting two students of mixed blood, and its need was too urgent to permit delay.

Adaptation of teaching to the mean intellectual level of students.—As regards their intellectual capacity, students of Polynesian and Micronesian origin are on a higher plane than those of Melanesian origin, and much ingenuity has been shown by the tutor and the school staff in adapting the teaching to the intellectual level of the average Melanesian without sacrificing the subject matter of the course, or unduly retarding the education of the more able students.

Cost of the Central Medical School.—The scheme under which the expenses of the school are shared between the participating Administrations requires each government to fill its quota for a specified period ; to pay fees on a *pro rata* basis and to pay a forfeit with respect to each unfilled item in its quota. This simple and equitable arrangement

has worked satisfactorily. The all in *per caput* cost of students at the Central Medical School amounted to £73 in 1934. Only Government students are admitted to the school and no student is admitted in a private capacity.

Administration.—The Governor of Fiji and High Commissioner for the Western Pacific is the supreme authority in the administration of the Central Medical School, and he is assisted by an Advisory Board consisting of Dr. S. M. LAMBERT of the Rockefeller Foundation, the Secretary of the Western Pacific High Commission, the Medical Superintendent Colonial War Memorial Hospital, and the Director of Medical Services, who is the Board's *ex officio* chairman. The title of Tutor was changed to that of Principal on the 1st January, 1936. No administrative difficulties of any consequence are caused by the heterogeneous origins of the students, and in the maintenance of discipline the Principal is loyally assisted by the head student and by a students' Council. There is also a fine *esprit de corps* in the school, which is perpetuated in the lives of its graduates.

Preservation of native character in school life.—The diploma of Native Medical Practitioner, as its name implies, is intended to be awarded to graduates of pure native blood. The term Indian Medical Practitioner is applied in the case of East Indian graduates who have been trained in the school in circumstances that are peculiar to Fiji. The essentially native character of the service is stressed as much as possible in the living conditions of the students, who are encouraged to dress themselves after the manner of well-bred natives, and to retain all of their native manner of living that is possible under conditions of studentship. This ensures, as far as it is possible to do so, that graduates shall return to their homes with a wholesome respect for the customs and manners of their own people and glide easily into their proper groove in the native social system, whence they can most readily spread the knowledge they have acquired. There is no present need for a service of native doctors with qualifications approximating European standards, and if a time should ever come when it may be desirable to train natives for positions of the highest responsibility in the medical services of the Pacific Islands, it will be fitting to give them the benefits of the more comprehensive education that is available in a large medical college in Australia or New Zealand, and to permit the Central Medical School to continue in the discharge of its present useful function. Any raising of the status of its diploma towards a European level would defeat the objects of the Central Medical School, both by encouraging the graduates to demand higher rates of salary and by removing them from their place in their native social environment. Since, therefore, the retention of the diploma at its present level would seem to be fundamental to the purpose for which the school was created, the safeguarding of this principle cannot be regarded as reflecting unfavourably either on the staff or the students of the Central Medical School.

Supervision of Native Medical Practitioners.—In the case of Fiji it has been found that regular inspection tends to encourage Native Medical Practitioners to keep their efficiency at a high level, and, this principle being applicable everywhere, should be practised as far as circumstances allow. But there is no justice in the argument, which is not infrequently heard, that in the absence of inspection the work of a Native Medical Practitioner ceases to be of value, for it has been refuted by the example already quoted of Sowani Puaman, and by the conduct

of countless others working under conditions of comparative isolation. The enlarged scope of the service must embrace many situations in which Native Medical Practitioners will be thrown almost completely on their own initiative, and it is therefore fortunate that they have proved themselves capable of rising to such occasions, and that their training in the Central Medical School deliberately aims at inculcating a spirit of independence of thought and action.

The similarities that are found everywhere in the conditions under which Native Medical Practitioners are working demand the application of uniformity and continuity of policy. Pending the unification which is contemplated to embrace the medical services of most of the participants in the scheme, and the introduction of a system of regular inspections from headquarters in Fiji, centralization has already advanced far enough to enable the Native Medical Practitioner service to be controlled as a single unit with reasonable efficiency. The most important of existing co-ordinating influences is the recognition by the High Commissioner for the Western Pacific and by the Government of New Zealand of the Director of Medical Services in Fiji as Central Medical Authority with respect to the other administrations. He receives valuable assistance and advice from Dr. S. M. LAMBERT, who, as the representative of the Rockefeller Foundation, maintains a very close personal touch with the affairs of each Administration. A system is also in force under which regular reports on the work of the Native Medical Practitioner are received from each Administration, and commented on by the Central Medical Authority. Again, from the standpoint of the Native Medical Practitioner, close touch with the school and with one another is maintained through the agencies of the Post-graduate department of the Central Medical School, and of a journal entitled the "Native Medical Practitioner" which is published twice yearly at the schools. The Post-graduate school provides a very comprehensive refresher course which can accommodate four Native Medical Practitioners every year and which is keenly sought after by them. The school journal contains many articles written by Native Medical Practitioners and constitutes an important advance in their education.

While a Native Medical Practitioner is believed to exercise his maximum efficiency when working in the Administration of which he is a native, and it is not considered advisable to make general the practice of transferring these officers between different administrations, the general uniformity of conditions which exists throughout the islands where the system is in force has permitted of a Native Medical Practitioner of one group being successfully employed in another. Instances of this are to be found in the cases of the British Solomon Islands Protectorate and the New Hebrides Condominium, where the selection of suitable native students has presented temporary difficulties and vacancies in the Native Medical Practitioner Services have been filled satisfactorily by natives of Fiji.

Child Welfare.—No report on Medical activities in the Southern Pacific can be regarded as complete without some reference to Child Welfare Work, which has been carried out with amazing success in Fiji since its introduction in 1927, and which is being extended through the Native Medical Practitioners to the other territories. Child Welfare now forms a special subject in the syllabus of the Central Medical School, and both students and Post-graduates are given a very practical training in these duties in the native villages situated

in the Suva neighbourhood. Experience has shown very clearly the necessity both for keeping the level of Child Welfare Work within the capacity of the native women and of delegating to them as much as possible of the responsibility for carrying it out. The main object of the work is to inculcate a spirit of self-reliance, and it would inevitably be defeated if the natives were led to believe that success is in any way dependent on complicated health surveys by scientifically trained officials or by the use of drugs and food substitutes. All this is not to deny the great value that attaches to visits of inspection by persons qualified to help and advise, and it is in this direction that Native Medical Practitioners keep the work at a high level of efficiency by maintaining the closest possible touch with the village workers. It has been observed in the case of Fiji that Child Welfare Work has greatly raised the status and importance of the women, and that their insistence on cleanliness in the interests of the children is having a remarkable effect in improving the sanitation of the native villages.

Through the influence of Child Welfare, public health is being made to enter the lives of these native peoples at birth. Its persistence during childhood and adolescence is ensured by the teaching of hygiene in schools as well as by the medical inspection of school children, and it is safeguarded in their adult life by the extreme accessibility of the Native Medical Practitioner system.

Conclusion.—Taken individually the Administrations participating in the Native Medical Practitioner scheme have not the means to embark on elaborate enterprises to provide adequate medical services, but by a pooling of their resources, as is now the case at the Central Medical School, it is felt that they will be able to elaborate a common form of health organization that will bestow further benefits on the native peoples. In Fiji the system has been proved successful after a long and searching trial, and if it is too early yet to claim the same success with regard to its more recent ramifications into the other Pacific Administrations, the similarity of conditions and the favourable reports that are coming to hand appear to provide full justification for the confidence which those of us who are in the closest touch feel with regard to the future of the Native Medical Practitioner in the Pacific. As the system becomes more permanently established everywhere it will suffer progressively less from the effects of destructive criticism, but there will always remain the danger that some over enthusiastic supporters may lose sight of the fundamental cause of its success and in a misguided attempt to raise the status of the Native Medical Practitioner may defeat the purpose for which the school was created, namely to make a health service available to these native peoples at a low cost and in the form that is most easily assimilable by their society.

MALARIA.

FEDERATED MALAY STATES. **Annual Report of the Malaria Advisory Board for the Year 1935** [KINGSBURY (A. Neave), Chairman].—13 pp. With 1 chart. 1936. Kuala Lumpur: F.M.S. Govt. Press.

Monthly returns of malaria cases admitted to Government and estate hospitals in the four States of the Federation indicate that the Federated Malay States has entered upon a period of increasing malaria incidence. Periodicity of malaria in Malaya is irregular, being influenced by Indian and Chinese immigration; the majority of these immigrants are stated to be relatively non-immune. Immigration in its turn is influenced by trade "booms" and "slumps." The Malaria Advisory Board do not consider it likely that a widespread epidemic of very serious and explosive type will occur, but precautionary measures have been adopted. Wherever local incidence has been excessive the brush method of oiling at ten-day intervals has been replaced by the original spray method of oiling at seven-day intervals, a change which has been followed by a reduction in the number of cases reported. Such an intensification of larval control is easy of application in areas under the control of the Sanitary Board and on large plantations and mines, but in *kampong* areas the control of mosquito-breeding, in existing circumstances, is difficult or impossible. For this reason a bill to provide for the destruction of mosquitoes has been drafted and will shortly be enacted.

Reference is made to the results obtained with atebrin musonate (methyl-sulphonate) in the treatment of malaria. This drug was found to be more powerful than either atebrin or quinine in its immediate effects on parasites and on fever. It had, however, no effect on the number and viability of gametocytes. These were able to infect mosquitoes readily on the seventh day after treatment when the drug was still present in the system in comparatively large amounts. The minimum daily effective dose, on each of two successive days, appeared to be 0·3 gm., either intramuscularly or intravenously.

In collaboration with the Malaria Commission of the Health Organisation of the League of Nations experiments are being carried out to determine the value of atebrin as a clinical prophylactic.

The Report contains information regarding the local costs of oil spraying; the deterioration of open cement drains under the influence of acid water; experiments with fascine drainage, and the control of anopheline breeding by shading. The Anopheline Survey of part of the Selangor Coast Area continues. *A. hyrcanus* var. *sinensis* and *A. vagus*, generally considered to be fresh water breeders, are frequently associated with *A. sundaicus*, a salt water species. As rainfall increased *A. vagus* replaced *A. sundaicus* completely in certain breeding places.

During the year the mail trains arriving in Kuala Lumpur from Singapore and from Penang were searched for anophelines; considerable numbers were found. One *A. aconitus* was found to have a gut infection.

Norman White.

ANTONINO (Lambusta). Profilassi antimalarica nelle zone tropicali con speciale riguardo alle nostre colonie in Africa Orientale. [**Malaria Prevention in the Tropics with Special Reference to Italian Colonies in East Africa.**]—*Ann. di Med. Nav. e Colon.* 1936. May–June. 42nd Year. Vol. 1. No. 5–6. pp. 211–220. With 1 chart & 6 figs. on 2 plates. [14 refs.]

This paper was evidently written for the special benefit of medical officers working in Italian Colonies in East Africa. It contains some general statements regarding the importance of malaria as a cause of morbidity and death in tropical countries, a description of the more important anopheline vectors in East Africa and a good summary of anti-malaria measures. The plates illustrating the characteristics of African anophelines are reproduced from Memoir No. 3, 1927, of the Liverpool School of Tropical Medicine. *N. W.*

KOMP (W. H. W.) & CLARK (H. C.). **A Fifth Year's Observations on Malaria in Panama, with Reference to the Failure of Atabrine to control an Epidemic.**—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 109–131. With 1 chart. [10 refs.]

It is not only useless but even harmful to attempt to control malaria by means of drugs in a hyperendemic area like Panama.

The authors conclude:—"It is galling to make a confession of failure, but our recent experience, and the deductions of other workers, lead us to believe that, under our local conditions, it is to the people's best interests (and ours) to interfere as little as possible with the course of their malaria infections. Our main object, increasing the efficiency of native labor, may be accomplished by treating only those actively ill among the adults, and allowing the children to build up an immunity through repeated attacks of the disease . . . treatment can be entrusted to an intelligent native "practicante," and may be instituted without the necessity for time-consuming expensive blood-surveys. For such treatment, atabrine would seem to be the drug of choice, because of its lack of toxicity, ease of administration, and rapid curative effect." For six years they have been carrying out experiments with the object of controlling malaria in villages by means of drugs and during the last two years they have treated every person found positive with atebrin gram 0·2 daily for 5 days, followed by plasmoquine 0·02 gram daily for a further 5 days. As regards plasmoquine, there were cases with toxic reactions, but they were not so frequent as when the two drugs were given simultaneously. The authors believe that there is little use in administering plasmoquine in therapeutic doses for the purpose of destroying crescents, because in 90 per cent. of their cresent cases the crescents appeared on the first day on which parasites were found, and had doubtless infected mosquitoes before treatment was begun. "This, together with . . . the severe toxic effects sometimes associated with its use, lead us to believe that no results can be obtained sufficient to warrant the use of this costly drug."

Malaria in Panama, as elsewhere, is subject to cyclical variations. An epidemic of malaria swept over the country in January, 1935. The villages under prophylactic drug control with atebrin and plasmoquine not only suffered as much as the control village, they suffered even more. During the epidemic period every person living in the atebrin-treated villages, whose blood was positive, was treated

until negative, but, nevertheless, the parasite rates continued high. In some of the atebrin-treated villages the incidence of malaria was greater than in the untreated controls; heavy infections and serious cases were commoner, and the proportion of crescent cases was greater. "Some unfavorable factor was active during the epidemic period, and we believe this to be the lowering of the natural immunity (or tolerance) of the community, caused by relative freedom from low-grade infections. In the usual course of events, as typified in the control town of Chilibre, only the clinical, disabling infections would be treated by the patients themselves, leaving the subclinical, low-grade chronic infections to smoulder untreated. We have interfered with this natural course in our treated towns, by endeavoring (with a considerable degree of success) to stamp out even the low-grade, chronic infections, particularly those which occur in young children. The results of this interference developed during the epidemic period. A high infection rate, an increased number of clinical cases, and a great increase of heavy infections occurred, particularly in those towns most thoroughly treated." A high crescent rate was associated with the high rate of heavy infections especially in children. (See JAMES, below.)

The authors draw attention to the occurrence of malaria in cyclical waves. They do not believe that the peaks of malaria incidence are due to an abundance of mosquitoes, but ascribe them to variations in the immunity of the population. They point out that, in judging the value of any method of malaria control, it is necessary to determine in advance the natural trend of the malaria rate. The literature is full of reports of successes which were judged successes because malaria rates dropped after control measures had been instituted at the top of the peak of incidence.

The authors have found that "quinine provided without supervision of treatment, in the expectation that such a measure will reduce the malaria parasite rate among a native population, is a delusion and an indefensible waste of money."

[See this *Bulletin*, 1935, Vol. 32, p. 784, for authors' report on fourth year's observations.] *W. Fletcher.*

MONTESTRUC (E.). Le paludisme à la Martinique. [**Malaria in Martinique.**]—*Bull. Soc. Path. Exot.* 1936. Feb. 12. Vol. 29. No. 2. pp. 193–202. With 1 map.

Malaria in Martinique is a less serious disease than in many other islands of the Antilles. Europeans seldom suffer and blackwater fever is unknown. All three types of parasites have been found. The author found parasites in about 5 per cent. of 2,000 slides examined. He considers that it would be easy to control malaria because it is limited to certain parts of the island where it could be dealt with readily. *W. F.*

MORIN (H. G. S.), GASCHEN (H.) & NGUYEN-DINH-HAO. Recherches sur le paludisme des voies d'accès au plateau du Trân-Ninh. [**Malaria on the Routes to the Plateau of Tran-Ninh.**]—*Bull. Soc. Méd.-Chirurg. Indochine.* 1935. Nov. Vol. 13. No. 9. pp. 1221–1246. With 4 figs & 1 chart.

Malaria at a high altitude.

Malaria is very severe, and blackwater fever is common at the military station of Nonghet, near the plateau. It is situated at an

altitude of 1,500 metres (nearly 5,000 feet), in about 19° north latitude. The carrier is *A. minimus*. The following anopheles were found at almost every station from the plains to the plateau: *A. minimus*, *A. maculatus*, *A. sinensis*, *A. jeyporiensis*. The authors conclude that the highlands have been contaminated by immigrants and soldiers who have come from hyperendemic areas. *W. F.*

GEAR (H. S.). **A Note on Malaria in China. The Chinese Medical Association Hospital Survey.**—*Chinese Med. Jl.* 1936. Feb. Vol. 50. No. 2. pp. 131–136. With 1 fig.

Twenty-five hospitals in provinces throughout China co-operated in returning records of all new patients treated both in ward and dispensary for the year 1934. The results can be taken as an indication of the seasonal incidence of malaria in China as a whole. Malaria patients apply for treatment throughout the year, the greatest numbers in the summer, from June to September, and the smallest numbers in January and February. Malaria accounted for 1·6 per cent. of all patients treated. Benign tertian was the commonest type of infection. All types occurred throughout China. Benign tertian had its peak in July, quartan in October, malignant tertian in November.

W. F.

STROMQUIST (W. G.). **Malaria Control in the Tennessee Valley.**—*Civil Engineering.* 1935. Dec. Vol. 5. No. 12. pp. 771–774. [Summary taken from *Public Health Engineering Abstr.* Washington. 1936. Feb. 29. Vol. 16. Signed J. A. LEPRINCE.]

This is a short discussion of the malaria problem of the Tennessee Valley in connection with the construction of four large lakes of irregular outline in a malarious territory. It is probably the best article written in recent years dealing with engineering phases of malaria problems connected with impounding of water on a large scale. The total shore lines to be cared for will approximate 2,500 miles. The writer gives a clear and concise idea of control procedure which will be of decided value to engineers on other large projects, both here and in other countries, and invites attention to the way in which the water power operating officials co-operate in malaria elimination. Better, quicker, and less costly methods of malaria control are desirable, and the author refers to experimental studies now being made towards these objectives. Three chart diagrams show the influence of water level fluctuation and anti-larval operations on anopheles production in the lakes. The information given covers up-to-date practice, and the experimental work and data being collected will be of decided future value.

EARLE (W. C.), PALACIOS (L. D.) & ARBONA (A.). **Methods used to control Malaria in Puerto Rico.**—*Puerto Rico Jl. Public Health & Trop. Med.* 1936. Mar. Vol. 11. No. 3. pp. 434–456. With 6 figs. [Spanish version pp. 457–478.]

Malaria here is best dealt with by permanent drainage carried out by engineers.

Malaria abounds in the main endemic centres of Porto Rico, because of natural conditions; it is not man-made. The most densely populated

parts of the island are the most malarious. The principal industry is the cultivation of sugar-cane ; drainage favours this and, at the same time, limits the breeding of *A. albimanus*, the carrier. In the past, inspectors were sent to search out and treat cases of malaria. This, the authors think, was waste of money. Many of the people with parasites were not ill. " If every malaria patient with active symptoms could receive the few days' treatment necessary to relieve him of his attack, the greatest amount of good would be obtained at the least expense." *A. albimanus* breeds in almost any natural water deposit not too densely covered by vegetation. Larva-eating fish proved useless ; minor drainage work and Paris green required too much supervision and were too costly ; the authors came to the conclusion that permanent engineering methods such as subsoil drainage, flooding with sea water, etc., were necessary. Details are given of various ways of dealing with swamps by short-circuiting the rivers which feed them. " For the present, at least, the problem should be looked upon as one requiring a period of years for solution . . . . Most of the breeding areas can be permanently destroyed by various types of drainage operations ; no matter how limited the resources, a little work of this type should be done each year." *W. F.*

BOGOJAWLENSKI (N. A.). Ueber friedliches Zusammenleben von Gambusien und Anopheleslarven in der Natur. [**Peaceful Symbiosis of Gambusia and Anopheles Larvae in Nature.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1936. May. Vol. 40. No. 5. pp. 201–203.

The observations were carried out in the spring and summer of 1935 in the district of Lenkoran, the most southern part of Azerbaijan. In the rice fields are many breeding places of mosquitoes. The vectors of malaria there are : *Anopheles maculipennis*, *A. hyrcanus*, *A. superpictus*, *A. pulcherrimus*, and *A. bifurcatus*, but *A. maculipennis* is the most important. The splenic index is 61 and the Ross index 3·4. Gambusia, the larvivorous top-minnow, is present in practically all the pools of water in Lenkoran, but, in spite of this, malarial mosquitoes are very numerous, not only in summer but also in winter. He considers that the simultaneous occurrence of these small fish and anopheles larvae is not accidental, but is a definite biological association. One cause of the failure of the Gambusia to attack the anopheles larvae is the enormous number of water plants in the streams. Not only did this vegetation hinder the fish from attacking the larvae, but it also afforded them abundant food in the form of animal and vegetable organisms, causing them to ignore the larvae as a source of food. The author's observation is not an isolated one, and others are quoted by him from the literature. So in Lenkoran they cannot expect any help from this antimalarial measure, although these small fish in other parts may be useful for the purpose.

E. D. W. Greig.

RYBINSKY (S. B.) & OVCHINNIKOV (M. M.). **Experiment on rearing Gambusia in Ponds near Kiev (Ucraina).**—*Riv. di Malariologia.* Sez. I. 1935. Vol. 14. No. 4. pp. 369–376. [22 refs.]

The fish died in winter when the ponds were covered with ice. *Gambusia affinis* was first brought to Russia in 1926 ; it flourished

in the Abknasian subtropical climate and rendered oiling superfluous, so that in a single "tropical station the rearing of Gambusia curtailed by 200,000 roubles the expenses for the anti-malarial clearing of ponds." The extension of propagation in the colder northern districts therefore became important. Successful experiments were carried out at Odessa by PRENDEL and his colleagues, where the fish lived for 3 months under ice and multiplied well during the following summer. The authors therefore tried to breed them at Kief. Gambusia were put into pools in June 1933, and by October they had multiplied enormously. Some were then put into small ponds with stream water and subaquatic vegetation. In December, they could be seen swimming underneath the ice; the water temperature was 3°C.; the fish had food in their stomachs. By the following April all were dead; probably from lack of oxygen, shortage of food or the accumulating of toxic substances in the water, rather than from cold. The authors urge that the larva-destroying value of indigenous fish should be more thoroughly investigated. *W. F.*

DE CAMELIS (F.). La polinevrite malarica. (Contributo clinico.) [**Malarial Polyneuritis.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 3. pp. 222–228. French summary (7 lines).

Polyneuritis is not a common complication of malaria. Its occurrence would appear to be determined by the intensity of the infection and certain climatic conditions. It often comes on gradually at the beginning of convalescence. The importance of making an early diagnosis is stressed so that specific treatment may be adopted forthwith. A typical case is described in detail. *N. W.*

DEBBASCH (G.), CALO (A.) & BURGARELLA (M.) Syndrôme nerveux aigu polymorphe chez une hérédo-spécifique au cours d'un accès pernicieux de paludisme.—*Tunisie Méd.* 1936. Jan. Vol. 30. No. 1. pp. 16–20. With 1 chart.

CLEMENTS (F. W.). **A Papuan Field Experiment of Malaria Treatment.** —*Med. Jl. Australia.* 1936. Feb. 15. 23rd Year. Vol. 1. No. 7. pp. 235–237. With 1 map.

Fifty-one patients suffering from subtertian malaria were treated, approximately one half with quinine and the other half with atebrin. The drugs proved equally effective. The only by-effect was tinnitus in the quinine series. No observations were made as to the rate of relapse, nor would they have been of any value since the experiment was carried out in a hyperendemic area. *W. F.*

RAGIOT (Ch.) & MOREAU (P.). Deuxième série d'essais thérapeutiques d'une nouvelle formule à base d'alcaloïdes totaux suractives du quinquina. [**Treatment of Malaria with Cinchona Alkaloids.**]—*Bull. Soc. Méd.-Chirurg. Indochine.* 1936. Apr. Vol. 14. No. 4. pp. 353–360.

A record of the treatment of three cases of malaria, one infected with *P. falciparum*, another with *P. malariae* and the third with *P. vivax*, with injections of the total alkaloids of cinchona, reinforced with additional hydrochlorate of quinine. The results were uniformly unsatisfactory. The preparation used was reported to have given

satisfactory results in Morocco. The authors remark that hyperendemic malaria of certain tropical countries, of which Cochin-China is one, is a much more serious disease and, at times, much more refractory to treatment, than is malaria in more temperate climates. They think that this fact may explain certain contradictory therapeutic results obtained in different parts of the globe. *N. W.*

MANSON (D.). **Tebetren Treatment in Malaria.**—*Records of the Malaria Survey of India.* 1936. Mar. Vol. 6. No. 1. pp. 19–25.

The number of cases treated was very small. The author's summary and conclusion are as follows :—

"Tebetren was tried in a series of 21 cases of malaria and the relapse rate was 14·3 per cent. Tebetren reduced the duration of the febrile period in malignant tertian malaria in comparison with quinine but had no advantage in benign tertian cases . . . No bad after-effects followed treatment with tebetren . . . .

"Tebetren is an advance on quinine in the chemotherapy of malaria and is worthy of further trial. The 'relapse-reinfection rate' is considerably reduced and toxic after-effects are absent." (See this *Bulletin*, 1935, Vol. 32, p. 387). *W. F.*

KNOWLES (R.). **Monkey Malaria.** [Correspondence.]—*Brit. Med. Jl.* 1935. Nov. 23. p. 1020.

The plasmodium which exists as a harmless commensal in the blood of the Malayan monkey, *Silenus irus*, produces a virulent infection when injected into the common Indian monkey *Silenus rhesus*. This letter is written to point out that this observation was first made by NAPIER and CAMPBELL (this *Bulletin*, 1932, Vol. 29, p. 700). They were examining the blood of an *irus* monkey (wrongly identified at the time as *Cercopithecus pygerythrus*) in connexion with the experimental transmission of kala azar, when they came across the malaria parasites accidentally. They inoculated three other monkeys with its blood, two *Silenus irus* and one *Silenus rhesus*, with the result that a fulminant attack occurred in the *rhesus*. The strain was then handed over to Colonel Knowles's laboratory where the experiments were carried out which were summarized in this *Bulletin*, 1932, Vol. 29, p. 701, and in later numbers. *W. F.*

NAUCK (E. G.) & MALAMOS (B.). Ueber die Wirkungsweise der Malariaheilmittel bei Affenmalaria. (*Pl. knowlesi.*) [**Mode of Action of Antimalarial Drugs in Monkey Malaria.**]—*Klin. Woch.* 1936. June 20. Vol. 15. No. 25. pp. 888–891. [26 refs.]

An experimental study of antimalarial drugs in monkeys infected with *P. knowlesi*.

Monkeys received, half an hour after intravenous injection of atebrin or quinine, an intravenous injection of blood containing large numbers of *P. knowlesi*. Immediately following the injection parasites could be observed in the peripheral blood. Shortly after the contact of the parasites and the drugs morphological changes were noted in the former. The alterations produced by quinine and atebrin were different. In the case of the latter a solution of the parasite occurred whilst in the case of the former solution rarely occurred, usually a

thickening and shrinking of the protoplasm, which stained more intensely.

The occurrence of these morphological changes in the treatment of animals, in which the reticulo-endothelial system was intact, and in animals after splenectomy and blockade of the r.-e. system, must be interpreted as a *direct* action of the drug on the parasite.

E. D. W. Greig.

CHOPRA (R. N.) & MUKHERJEE (S. N.). **The Trend of Immunity Studies in Malaria.**—*Indian Med. Gaz.* 1936. Jan. Vol. 71. No. 1. pp. 34–39. [36 refs.]

A general review of the mechanism of immunity in malaria.

KRISHNAN showed that acquired immunity in monkeys belonging to susceptible species was generally associated with latent infection, but in resistant species immunity often occurred without this. In birds, on the other hand, immunity disappears if the latent infection is cured. (See this *Bulletin*, 1934, Vol. 31, pp. 179 and 463). TALIAFERRO found that the serum of immune birds did not protect normal birds. CANNON and TALIAFERRO (this *Bulletin*, 1931, Vol. 28, p. 494 ; 1933, Vol. 30, p. 726 ; 1935, Vol. 32, p. 425) showed that immunity in birds is cellular and consists of an increased rate of phagocytosis by the reticulo-endothelial system. They believed that the macrophages were stimulated by some opsonic antibody. BECHOLD demonstrated that the negative charge of bacteria is reduced when they are sensitized by an immune serum, and it is evident that both agglutination and phagocytosis resemble the coagulation of colloids where charged particles, on the reduction of their electric charge, approach one another and conglomerate. BROWN and BROOM (this *Bulletin*, 1933, Vol. 30, p. 830 ; Vol. 31, p. 352) showed that the electric charge on red cells was reduced in malaria and that this reduction promoted phagocytosis. Serum from an immune bird reduced the charge on cells from a normal bird ; but this action was non-specific, because the serum also reduced the charge on cells from any species of animal and even on bacteria. BROWN noted the charge-reducing action of the globulins in the serum and this fraction is increased in malaria. Although the existence of specific antibodies has not been directly demonstrated, indirect evidence from an analogy of the physical and serological behaviour of blood in both malarial and bacterial infections has been brought forward in support of this view. Chopra and his colleagues (this *Bulletin*, 1934, Vol. 31, p. 179), have found that the charge on infected cells is lower than that on healthy cells. In the ring stage of the parasite, the charge is slightly higher than normal ; in the mature stage, it is much lower. It has recently been found that changes in the plasma are perhaps more important than the electrical charges on the individual cells and "the question of artificially inducing such alterations in the blood may come up for consideration for the purpose of promoting immunity against this disease." (See this *Bulletin*, 1933, Vol. 30, p. 827.) *W. F.*

MOCHKOVSKI (Ch.). Les relations entre l'hôte et le parasite dans le paludisme. Considérations générales sur l'immunité et la virulence. (Premier mémoire.)—*Bull. Soc. Path. Exot.* 1936. Mar. 11. Vol. 29. No. 3. pp. 274–279.

BOYD (Mark F.) & STRATMAN-THOMAS (W. K.). **The Transmission of Quartan Malaria through Two Consecutive Human-Anopheline Passages.**—*Amer. Jl. Trop. Med.* 1936. Jan. Vol. 16. No. 1. pp. 63–65.

The author has already reported (this *Bulletin*, 1933, Vol. 30, p. 853) the successful transmission of two strains of *P. malariae* by means of *A. quadrimaculatus* ; he now reports the further passage of one of these strains to a second series of patients by means of *A. quadrimaculatus* infected by feeding on one of the 3 patients in the first series. Scanty gametocyte production in the second series did not permit further passage by mosquitoes. All the attacks began as quartan intermittents, and subsequently showed a tendency to become double quartan, and later triple quartan or quotidian. *W. F.*

BOYD (Mark F.) & KITCHEN (S. F.). **The Comparative Susceptibility of** *Anopheles quadrimaculatus*, **Say, and** *Anopheles punctipennis*, **Say, to** *Plasmodium vivax*, **Grassi and Feletti, and** *Plasmodium falciparum*, **Welch.**—*Amer. Jl. Trop. Med.* 1936. Jan. Vol. 16. No. 1. pp. 67–71.

Anopheles quadrimaculatus and *A. punctipennis* proved to be approximately equally susceptible to both strains of *P. vivax* employed in these experiments ; but, while *A. quadrimaculatus* was susceptible to all the strains of *P. falciparum* employed, *A. punctipennis* was very susceptible to some and quite resistant to others. The capture of wild *A. punctipennis* with a gland infection has never been reported, and only a single instance of a stomach infection has come to notice, " it does not appear likely, despite its susceptibility, that it is a factor of any consequence in the propagation of malaria parasites." *W. F.*

BOYD (Mark F.), STRATMAN-THOMAS (Warren K.) & KITCHEN (S. F.). **On Acquired Immunity to** *Plasmodium falciparum*.—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 139–145.

Homologous immunity, but no heterologous immunity, follows infection with *P. falciparum*.

Recovery from infection with *P. vivax* is followed not only by immunity to the same strain but also by a very definite though less effective immunity to other strains. On the other hand, a patient who has recovered from an attack of subtertian malaria, even though he still has parasites in his blood, is not immune to a heterologous strain, and inoculation with such a strain will produce an attack which may be as severe as the first. *P. falciparum*, however, produces homologous immunity ; that is to say, re-inoculation with the same strain will not result in a second attack though it may result in a slight increase of the parasites in the blood. This homologous immunity lasts about four months after the infection appears to have been eradicated. *W. F.*

BOYD (Mark F.), STRATMAN-THOMAS (W. K.) & KITCHEN (S. F.). **On the Duration of Infectiousness in Anophelines harboring** *Plasmodium falciparum*.—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 157–158.

The infectiousness of mosquitoes with *P. falciparum* deteriorates much more rapidly than their infectiousness with *P. vivax*. After

the mosquitoes used in these experiments had matured their infection with *P. falciparum* the authors stored them in a Frigidaire, between 3° and 14°C. They found that nearly every person became infected who was bitten by these mosquitoes during the first 10 days. Subsequently, the effectiveness of the mosquitoes declined rapidly, and no inoculations were successful when more than 40 days had elapsed after the completion of the extrinsic incubation period (this *Bulletin*, 1934, Vol. 31, p. 701). *W. F.*

BOYD (Mark F.), KITCHEN (S. F.) & MULRENNAN (J. A.). **On the Relative Susceptibility of the Inland and Coastal Varieties of** *A. crucians*, **Wied., to** *P. falciparum*, **Welch.**—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 159–161.

ROOT has shown that there are two strains or varieties of *A. crucians*—a coastal and an inland strain, indistinguishable as adults, but differing as larvae. The authors found no difference in their relative susceptibility to *P. falciparum* but they proved to be poor hosts in comparison with *A. quadrimaculatus*. *W. F.*

RAMSAY (G. C.), CHANDRA (S. N.) & LAMPRELL (B. A.). **A Record of an Investigation to determine the Androphilic Indices of Certain Anopheline Mosquitoes collected on Tea Estates in Assam and Northern Bengal.**—*Records of the Malaria Survey of India.* 1936. Mar. Vol. 6. No. 1. pp. 49–52.

Infectivity surveys comprising 100,000 dissections have shown that *A. minimus* constitutes 98·3 per cent. of the specimens infested with malaria. The precipitin test shows that this mosquito is highly anthropophilic. *A. leucosphyrus* also prefers human blood but the authors have not found it acting as a vector. It was not prevalent in the area under investigation. Out of 622 *A. minimus*, 85 per cent. contained human blood; of 102 *A. leucosphyrus*, 75 per cent., of 311 *A. kawari* 16 per cent. Less than 10 per cent. of the following contained human blood: *A. maculatus*, *A. hyrcanus*, *A. kochi*, *A. subpictus*, *A. annularis*, *A. vagus*, *A. splendidus*. *W. F.*

VOLLMER (Ortrud). Kleiner Beitrag zur Kenntnis der Verbreitung der Anopheles im Rheinland. [**Distribution of Anopheles in the Rhine District.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1936. June. Vol. 40. No. 6. pp. 255–259. With 1 fig.

The author was very surprised at finding that not one courtyard investigated in the Rhine and hill districts between Elberfeld and Düsseldorf, also in Cleve, Uedem and Geldern, was without Anopheles. The Anopheles were found in the cattle and pig stalls; they preferred dry, dark, sheltered corners. He noted three races of *Anopheles maculipennis*, *viz.*, var. *atroparvus*, var. *messeae* and var. *typicus*. He describes the eggs of these three varieties as, "halfgrey," "dark" and "striped."

The author considers the question of "anophelism sine malaria" in Germany an important one, and hence the necessity for accurate knowledge of the distribution of their Anopheles.

E. D. W. Greig.

SEPULCRI (Piero) & DE NEGRI (Ugo). Osservazioni sull'anofelismo nel delta del Po e zone limitrofe. [**Anophelines in the Po Delta and its Vicinity.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 3. pp. 198–206. With 6 figs. on 1 plate & 1 map. French summary (4 lines).

This is the report of an anopheline survey of the Rovigo Province, which contains the Delta of the Po. Systematic captures made in twenty-four localities show that in the coastal belt *A. elutus* very largely predominates. Further from the sea *typicus* and *messeae* are chiefly in evidence. Certain abnormalities of egg structure were noted. *N. W.*

RAFFAELE (G.) & LEGA (G.). L'anofelismo nella piana di Rieti. Nota preventiva. [**Anophelism in the Rieti Plain.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 1. pp. 23–31. With 5 figs. (1 map). English summary.

The Plain of Rieti lies at the foot of the Sabini mountains, around the Lakes Lungo and Ripasottile, and about 400 metres above sea level and has a radius of about 6 kilometres. Anopheles abound there, *A. maculipennis*, the *messeae* variety predominating, but *A. m. typicus* and *A. m. melanoon* are also found, in the period from May to October. Thus, of 400 egg deposits examined 372 were *messeae*, 18 *typicus* and 10 *melanoon*, or 93, 4·5 and 2·5 per cent. respectively. One hundred and eighty-eight mosquitoes were tested by the precipitin method to determine their feeding source—whether cattle, horse, pig, sheep, or man. Of these 29·8 per cent. gave reactions for cattle and man, next 22·3 for cattle only, sheep and pigs were equal—6·3, man only 5 and horse 2 per cent. It will be seen that just over 36 per cent. had fed on man. The inhabitants of the district number nearly 5,000. In spite of the prevalence of Anopheles there is said to be no human malaria. *H. H. S.*

BEZERRA (Acrisio). Transmissores da malaria no Brasil.—*Folha Med.* 1936. Jan. 5. Vol. 17. No. 1. pp. 4–7.

MATHIS (C.). Elevage d'*Anopheles gambiae* à Paris. [**Breeding** *A. gambiae* **in Paris.**]—*C. R. Soc. Biol.* 1936. Vol. 121. No. 1. pp. 21–22.

The author has bred these Anopheles successfully in his Paris laboratory from specimens imported from the West Coast of Africa. They are now in their 6th generation. They are harder to breed than in the tropics. The water for the larvae was aerated with a pump such as is used for amateurs' aquarium tanks. Glass rods are put in the vessel in order to prevent air bubbling violently through the water. When the temperature is very cold the water is kept warm. The larvae are fed on *Chlamydomonas* sp., *Chlorella vulgaris* and a *Pleurococcus*. The adults, which copulate readily in a small space, are fed on guineapigs, or on human volunteers, and are kept in cages covered with a damp cloth. *W. F.*

WANSON (M.). Influences de la salinité sur la faune culicidienne. [**The Influence of Salinity upon Mosquito Breeding.**]—*Ann. Soc. Belge de Méd. Trop.* 1935. Dec. 31. Vol. 15. No. 4. pp. 587–598.

The author has found that the Anopheles of Banana (*A. gambiae* is the only species) consist of two groups, long-wings and short-wings. The short-wings come from the crab-holes and small tidal pools, where the amount of water is small and the concentration of larvae and waste products high. The long-wings come from the big marshes. *A. gambiae* in the laboratory deposited eggs in water containing as much as 60 grams of chlorine per litre, but not in that containing 80 grams. The favourite concentration was up to 25 grams. The larval cycle, in nature, was habitually completed at concentrations between 15 and 40 grams per litre, and sometimes in concentrations as high as 55·41 and even 61·20 grams. In the higher concentrations, development was delayed and the imagos were smaller than normal. *W. F.*

TREILLARD (M.). La biologie des espèces anophéliennes du groupe *minimus-funestus* et son utilisation pratique. A propos de récentes expériences. [**Biology of Species of the** *minimus-funestus* **Group of Anopheles.**]—*Bull. Soc. Path. Exot.* 1936. Apr. 1. Vol. 29. No. 4. pp. 396–402.

The author is anxious to make better use of existing knowledge of the biology of *Anopheles minimus*. He contrasts it with its near relations of the *funestus* group in South Africa.

In the author's experience in Annam and Cochin China, *A. minimus* is often numerous in houses, it is apparently very long-lived, and it is known that it prefers the blood of man, so that without doubt it is one of the major carriers of malaria. The natural breeding places are often scattered and difficult to discover, so that control by any larvicidal method may be incomplete and expensive. The view is put forward that it would be worth while to attempt to control the insect by killing adults in houses by insecticidal sprays used once a week. It does not appear that this has been carried out in the countries in which the author has worked, but, as he points out, DE MEILLON and PARK ROSS in South Africa appear to be convinced that measures should in practice be directed against the adult *funestus* rather than the larva.

P. A. Buxton.

DE MEILLON (Botha). *Anopheles funestus* **Giles and** *Anopheles leesoni* **Evans in Human Habitations and Outdoor Haunts.**—*Ann. Trop. Med. & Parasit.* 1936. Apr. 8. Vol. 30. No. 1. pp. 1–2.

The critical discrimination of the females of *Anopheles funestus* and *leesoni* is a matter of great difficulty, which the author overcomes by selecting only those which are gravid and identifying them by the structure of the unlaid eggs. This of necessity limits the number of specimens capable of critical identification, and it might introduce a source of error if the females of one species entered houses and took human blood, but left the house before the eggs had matured.

The figures here published appear to show that the proportion of *funestus* infected with Plasmodium is considerably higher among those caught in houses than in those caught out of doors ; also that *leesoni* is rarely caught in houses. As tests for significance have not apparently been employed it is not easy to know how much reliance can be placed upon the published figures, the amount of material available being at present rather small. *P. A. B.*

i. WEYER (Fr.). Ueber den Cl-Gehalt und das pH verschiedener Brutgewässer von *Anopheles maculipennis* in Norddeutschland und die Beziehungen zur Rassenfrage. [**The Cl-Content and the pH of Various *Anopheles maculipennis* Breeding Places in North Germany, and their Relation to the Racial Question.**]—Reprinted from *Arch. f. Hydrobiologie.* 1934. Vol. 27. pp. 595–608. With 3 figs. [13 refs.]

ii. MARTINI (E.). Ueber den Salzgehalt der Gewässer und die Malarialage. [**The Salinity of Bodies of Water in Relation to Malaria.**]—Reprinted from *Entom. Beihefte Berlin-Dahlem.* 1934. Aug. 7. Vol. 1. pp. 28–44. With 3 figs.

i. In the *Anopheles* region of North Germany, especially in E. Friesland, Neuwerk I., the Elbe marshes, Mecklenberg and on the Pomeranian coast, numerous *A. maculipennis* breeding places were investigated as regards their Cl-content and the pH. In typical breeding places in E. Friesland (usually small pools for watering cattle, 5–10 metres in diameter, with overgown banks), the Cl-content varies from 0·034 to 0·661 per cent., and the pH from 6·8 to 8·2 per cent. In Mecklenburg in certain places the Cl-content is as high as 3·0 per cent. As regards the area occupied by the race *atroparvus* in Germany and in Holland, the Cl-content of breeding places is on the average considerably lower in the former than in the latter. In the part of North Germany where this race occurs, the water in the breeding places is very often fresh. Eggs of *atroparvus* were frequently observed on fresh water pools, and conversely in certain cases eggs of the race *messeae* were found on water the Cl-content of which was high (brackish water). The same fresh and brackish water pools also yielded eggs of the *typicus* race. In the course of the year the Cl-content of a body of water, probably as a result of climatic conditions, varies considerably. There is no strict correlation between the presence of a given race and the Cl-content of the breeding places, but hitherto the race *messeae* exclusively has been found only in fresh water districts, while brackish water is a preferred medium in the case of *atroparvus*. Since, however, *atroparvus* larvae are very frequently met with in fresh water also, this race, as regards its oecology, shows itself to be more labile and adaptable than *messeae*. A reliable deduction as to the racial character of an *Anopheles* population cannot be based solely on the Cl-content of the breeding places.

ii. After a general discussion, chiefly concerning the differences between the races (or species ?) *A. maculipennis atroparvus* and *A. m. messeae*, and their local occurrence in Germany and other parts of Europe, the author settles down to the real problem, namely conditions in the Danube delta, some light on which is thrown by the following percentages, quoted from ZOTTA.

Pruth Valley, near Galatz, absolute malaria index 35 ;
Danube Valley, between Galatz and Tulcea, absolute malaria index 27 ;
Danube Delta, below Tulcea, absolute malaria index, 6.

In the Danube Delta the rare *messeae* occurs almost exclusively ; further south, where a broad sandy tract separates Delta and sea, *atroparvus* is found. In the Danube villages, despite the fact that they are infested solely by *messeae*, malaria-indices are very high ; more than 60 per cent. of the school children show signs of the disease, and the idea that *under no circumstances* can *messeae* be responsible for malaria endemics must therefore be abandoned. On the other hand this by no means amounts to proof that, as a vector of malaria, it is *just as efficient* as *atroparvus*. Nevertheless, shortly after the War a wave of malaria swept over a great part of Rumania, including the Delta, which had largely been deprived of the protection afforded by cattle, and throughout the Danube area, whether severely or slightly attacked, *messeae* is practically the only race of *Anopheles* that occurs.

The lowness of the malaria rate in the Danube Delta is possibly due in the first place to the well-nourished condition of the population, children included. A second factor is, somewhat paradoxically, the abundance and bloodthirstiness of mosquitoes, especially *Mansonia richardii*, which breeds in the reed swamps in myriads, and whose attacks, combined with those of other species, cause the universal use of mosquito nets. Thirdly, about four times as many cattle are kept in the Delta as in other parts of Rumania, so that deviation of *Anopheles* thereby is correspondingly greater. The relative sparseness of the population, and the fact that summer temperatures in the Delta are lower than those elsewhere in Rumania must also be taken into account, and all this goes to show that in the Danube Delta the race of *Anopheles* is not in itself the decisive factor.

When searching for a purely *atroparvus* area in the Dobrudja, near Constanza, where there are brackish water lakes behind the coast line, the author found a solitary cottage, which, with a well-filled cemetery, was the sole remains of a village otherwise obliterated by malaria. The local mosquito, however, proved to be *A. elutus*, which is also responsible for the existence of severe malaria along the coast to the south, and has experimentally been shown to be especially resistant to salt water, even more so than *atroparvus*. That in the *A. maculipennis* group the more dangerous forms appear to display this resistance can hardly be fortuitous. The wide distribution of *Aëdes salinus* and *A. caspius*, two salt-fast species found along the shoreline from the Mediterranean to Scandinavia, would seem to show that ability to breed in salt water is of advantage in the struggle for existence. The development of the malaria germs depends upon the warmth of the environment, and the importance of the races of *A. maculipennis* from the point of view of malaria must vary with their temperature-constants and the localities that they prefer ; if the salt-faster forms are also the heat-faster, there must, as was believed by GRASSI and older German physicians, be some connexion between brackish water and the degree of danger from malaria. This being so, free irrigation with fresh water, coupled with good drainage, will afford an entirely new method of malaria-prophylaxis in *A. maculipennis* regions, and will curb the activities of the dangerous anopheline races. *E. E. Austen.*

EVANS (A. M.). **Notes on Anophelines. I.—Description of** *Anopheles marshalli* **var.** *gibbinsi* **from Uganda. II.—The Characters of** *A. maculipennis* **var.** *messeae* **in Wirral, England.**—*Ann. Trop. Med. & Parasit.* 1935. Dec. 18. Vol. 29. No. 4. pp. 469–473. With 1 fig. [12 refs.]

I. The variety of *A. marshalli* here described as var. *gibbinsi* var. nov. while, in the adult female, very similar to the typical form as found in the Transvaal, exhibits certain structural differences in the terminalia of the male, and also in the egg, larva and pupa. In Uganda, as already shown by GIBBINS, "this variety is a common house-frequenter and an important vector of malaria at Fort Portal."

II. In 1934 the author noted the presence at Wirral of a form of *A. maculipennis* which, as regards egg- and hibernation-characters, agreed with var. *messeae* as described by continental writers. After studying further material from Wirral, including larvae and males raised from eggs, the following conclusion is reached :—

"The form of *A. maculipennis* studied in Wirral, Cheshire, is evidently morphologically almost identical with the Dutch form of var. *messeae*. The behaviour during hibernation is of the same general type as in Dutch *messeae*, although there appears to be greater variation in reaction to experimental conditions, and the period of complete hibernation may terminate on a somewhat earlier date. The variable reaction to experimental conditions supports the suggestion made by Professor SWELLENGREBEL (*in litt.*, December 22nd, 1934) that the occurrence of normal digestion and precocious ovulation as early as December may indicate a biological difference between the forms of *messeae* occurring in Holland and Wirral, England." *E. E. A.*

HACKETT (L. W.) & LEWIS (D. J.). **A New Variety of** *Anopheles maculipennis* **in Southern Europe.**—*Riv. di Malariologia.* Sez. I. 1935. Vol. 14. No. 5. pp. 377–383. With 1 plate. [6 refs.]

On the Mediterranean coast of Spain, as also in North-West Italy, Albania, and apparently in parts of Yugoslavia and Macedonia, there occurs a variety of *A. maculipennis* not yet recorded as found in Northern Europe, and, on the basis of egg, larval and adult characters, described in this paper as *A. maculipennis subalpinus* var. nov. As regards the main points of difference exhibited by this latest addition to an already formidable list, it seems that in the egg which is heavily barred :—"The floats always have a glossy appearance due to the absence or scarcity of intercostal ridges. It is this appearance rather than the actual presence or absence of ridges which distinguishes eggs of *subalpinus* from those of *messeae* and *typicus*, which always appear frosted." In the larva, there is a considerable difference between *subalpinus* and *messeae* in the "average number of branches of the antepalmate hair on the fourth and fifth abdominal tergites," and in the former this number is "higher than in *typicus*." In the male hypopygium, as shown by Albanian specimens, differences, as compared with conditions in *messeae* and *typicus*, are exhibited by the external spine of the harpago. The adult female, on the other hand, agrees in colour with that of other races.

"In Albania *subalpinus* is almost always the dominant race of *maculipennis* in stables near fresh water marshes. . . . Near Korça it oviposits like *messeae*, in open sheets of water and not in ditches."

E. E. A.

SERVAJEAN (Constant). Anophélisme sans paludisme. Le problème des races de l'*Anopheles maculipennis*.—97 pp. With 3 figs. & 1 map. [Bibliography.] 1935. Algiers: Imprimerie Nord-Africaine (S. Crescenzo).

SERGENT (Et.) & CATANEI (A.). Influence du froid sur les oeufs d'*Anopheles maculipennis* du littoral algérien. [**The Influence of Cold on the Eggs of** *A. maculipennis* **on the Coast of Algeria.**]—*Arch. Inst. Pasteur d'Algérie.* 1935. Dec. Vol. 13. No. 4. pp. 511–512. With 1 chart.

The experiments were carried out with the eggs of Anopheles caught in the neighbourhood. They were oviposited at a temperature of 25°C. and were exposed at once to a temperature of 5°C., in which they were kept for varying periods of 1, 2, 3, 4, 5 and 6 days, before being transferred to the optimum temperature of 25°C. The period of incubation of control eggs left at this temperature was one or two days. The incubation period was lengthened in proportion to the length of exposure to the low temperature; after 3 days' exposure it was about 3 days, after 7 days it was 7 days; after 10 day's exposure very few eggs hatched; after 14 days, they were all sterilized. *W. F.*

TOUMANOFF (C.) & HU (S. M. K.). Sur le comportement trophique d'*Anopheles hyrcanus* var. *sinensis* dans la région de Shanghai. [**Food Preference of** *A. hyrcanus* **in the Neighbourhood of Shanghai.**]—*Bull. Soc. Path. Exot.* 1935. Nov. 13. Vol. 28. No. 9. pp. 832–835.

A. hyrcanus var. *sinensis* is the only Anopheles in the district of Kiaochow; it is most numerous in stables, pigstyes and cowsheds where 97 per cent. contain animal blood. Nevertheless, there is always a little malaria, and, by means of investigations with mosquito traps, the authors found that the greatest amount occurred when the density of Anopheles was at its highest point. Precipitin tests showed that 95 per cent. of those caught in houses contained human blood, and 99 per cent. of those caught in cowsheds contained bovine blood. It appears that *A. hyrcanus* remains fixed in the neighbourhood of the stable or dwelling where it has first fed. At the time of greatest anopheline density, though most of them enter stables and remain there, a few enter human dwellings where they feed and remain.

W. F.

WALCH (E. W.) & WALCH-SORGDRAGER (G. B.). **The Eggs of Some Netherlands-Indian Anophelines.**—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1935. Vol. 24. No. 3. pp. 73–85. With 14 figs. on 2 plates.

The problem of racial differentiation as exhibited in Europe by *Anopheles maculipennis* may have its counterpart in the Oriental Region, where, for instance, *A. subpictus* is a malaria-carrier in the Dutch East Indies but not in British India, while, in different parts of the former, "*A. hyrcanus* (and its varieties) and *A. aconitus*" behave similarly. Devoting themselves at the outset to a morphological study of the eggs, the authors have been able to compare material from different parts of Java and Sumatra with the descriptions and figures of eggs of Indian anophelines published in 1931 by CHRISTOPHERS and BARRAUD. In the present paper detailed descriptions of or

notes on the eggs of the following species and varieties are given :— *A. hyrcanus* var. *nigerrimus* ; *A. barbirostris* ; *A. albotaeniatus* ; *A. tessellatus* ; *A. kochi* ; *A. punctulatus* ; *A. annularis* ; *A. annularis* var. *philippinensis* ; *A. maculatus* ; *A. aconitus* ; *A. vagus* ; *A. sundaicus* ; and *A. subpictus.*

In certain cases, as in the eggs of *A. vagus* and *A. subpictus,* noticeable differences from Indian specimens were found. In Java, *A. subpictus* breeds in salt or brackish as well as in fresh water, with a corresponding difference in the number of ribs in the egg-floats ; as regards the larval stage, the clypeal hairs would seem very often to be straight in the former and branched in the latter case. *E. E. A.*

WALCH (E. W.) & WALCH-SORGDRAGER (G. B.). Over de morphologische eigenschappen van verschillende subpictus eieren. [**Structural Differences in Eggs of** *A. subpictus.*]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1936. Feb. 18. Vol. 76. No. 7. pp. 394–422. With 5 graphs & 3 plates. English summary.

The paper discusses structural differences in eggs of *Anopheles subpictus* (*rossi*), laid in fresh and salt waters in Java.

In Java this mosquito breeds in waters exhibiting a wide range of salinity, up to about 2·49 per cent., a figure which approaches that of sea water. The eggs from fresh and salt waters fall broadly into two types, and seven points of difference are enumerated. But both in fresh and in salt water a considerable amount of variation occurs, and it seems that an egg may appertain clearly to one type in most of its characters, but to the other type in one or two of them. The fineness or coarseness of the columellae on the dorsum, which makes a great difference to the appearance of the egg, seems to be one of the less reliable characters. One is left with the impression that the most constant points of difference are :—

	Salt water.	Fresh water.
Average no. of ribs in float ...	Under 19	Over 21
Length of float/length of egg ...	About 0·5	About 0·6

These numerical characters are carefully discussed, standard deviations of means being given.

The authors suggest that perhaps two definite races exist, which produce hybrid intermediates in certain areas. The possibility occurs to the reader that the differences observed are due to some unidentified physico-chemical cause other than salinity, and that the solution of the problem may lie rather in the laboratory than the field. *P. A. B.*

i. RAYNAL (J.) & GASCHEN (H.). Méthode des précipitines appliquée aux anophèles. Résultats en Indochine-Nord.—*Bull. Soc. Path. Exot.* 1935. Dec. 11. Vol. 28. No. 10. pp. 937–943.

ii. TOUMANOFF (C.). L'épreuve des précipitines appliquée à l'étude des habitudes trophiques chez quelques culicines d'Extrême-Orient. [**The Food of Mosquitoes in Northern Indo-China as determined by the Precipitin Test.**]—*Ibid.* pp. 943–948.

Both papers report results obtained by applying the precipitin reaction to the blood found in stomachs of mosquitoes in Indo-China.

i. The authors applied their test to individuals of sixteen species of Anopheles, but the figures for many species are small and there are only seven species on which a hundred or more tests were performed.

It was shown that the members of all these seven species feed to some extent on animals, *hyrcanus*, *vagus* and *aconitus* to a large extent ; only *minimus* and *jeyporiensis* appear to feed more upon man than upon animal Work in other directions has already shown that these species in particular frequent houses and that they are most commonly found infected with plasmodium (for instance 3·69 per cent. of 4,488 *minimus* contained sporozoites). The precipitin test may therefore be said to confirm previous work in other directions.

ii. The paper reports tests carried out on common domestic Culicines, nearly all of them *Culex fatigans*, *Aëdes aegypti* and *A. albopictus*. The total numbers were not very high but the conclusion is reached that these species specialize much more in man's blood than does any of the Anopheles species in the locality. Indeed even when they are taken in stables it is frequently found that the Culicines have been feeding upon a human being. The following figures, for instance, are quoted : 96 positive reactions were obtained for *Culex fatigans* taken from houses and in each case the blood was human : 72 positive reactions were obtained from individuals from stables, and of these 61 had fed on man, 11 on buffalo. *P. A. B.*

SHUTE (P. G.). **Agglutination of the Red Blood-Corpuscles of Man, Animals and Birds by the Salivary Glands of** *Anopheles maculipennis*.—*Jl. Trop. Med. & Hyg.* 1935. Nov. 15. Vol. 38. No. 22. pp. 277–278. With 6 figs.

The gland juice of *A. maculipennis*, var. *atroparvus* and *messeae*, agglutinated the blood corpuscles of man, animals and birds. The salivary glands of *A. claviger*, *A. plumbeus*, and 8 species of *culex* produced no agglutination. The glands of male *maculipennis* caused no agglutination. *W. F.*

STRICKLAND (C.) & ROY (D. N.). **Experimental Malarial Infection of** *Anopheles subpictus* **Grassi** (*A. rossi* **" type " Giles).**—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1936. Feb. 18. Vol. 76. No. 7. pp. 387–393. [12 refs.]

A. rossi were fed on persons infected with malaria. The following numbers of mosquitoes were subsequently dissected : 143 which had fed on subtertian cases, 49 which had fed on benign tertian, 29 which had fed on quartan. No gland infections were found, but among the mosquitoes fed on the subtertian cases zygotes were found in two and black spores in four. The authors conclude that this mosquito " has a very low infection rate with malarial plasmodia in Calcutta, even when *A. stephensi*, used as a strict control, is becoming infected at the rate of nearly 100 per cent." They suggest that the high rates of infection obtained by SOESILO and some other workers may have been due to the use of a subspecies of *A. rossi* in their experiments. *W. F.*

NEOGI (Sushil Kumar). **Study of the Bionomics of** *Anopheles sundaicus* (*A. ludlowi*) **in the Salt Lakes of Calcutta.**—*Records of the Malaria Survey of India.* 1936. Mar. Vol. 6. No. 1. pp. 31–47. With 1 map & 2 charts.

The author discusses the factors which might account for the spread of *Anopheles sundaicus* (*ludlowi*) during recent years in the immediate vicinity of Calcutta.

It has been feared for a good many years that the Salt Lakes, an area of many square miles of saline swamp immediately east of the city of Calcutta, might become an important breeding place of this dangerous species of Anopheles, but it was only in December 1932 that the insect began to be numerous. The author endeavours to define some of the conditions prevailing in the breeding places, hoping to discover the cause of the mosquito's increase. As the species is well known to breed in brackish water he gave attention first to salinity, which was determined in 863 samples in which larvae were also found. It is clear from the figures that the species generally breeds in a water of rather low salinity, 60 per cent. of the findings being associated with salinity less than 150 parts per 100,000 : but occasionally larvae are found in water the salinity of which approaches that of sea water. It would perhaps have added to the value of the work had the author examined the salinity in a number of spots which appeared suitable but from which larvae of this insect were absent. Rather similar figures are tabulated for the albuminoid ammonia and for the plants found in association with larvae : also for the mean shade temperature during the months of the investigation. The author devotes some attention to the statistical side of the work and uses correlation and partial correlation to assist him.

An interesting paper is brought to an end by a discussion of the general problem which has so recently arisen and become pressing. Evidence of several sorts leads to the view that, owing to natural alterations in certain river channels, the Salt Lakes are now less salt than they were. This in turn appears to suggest that the change which is in progress might go further and lead to the replacement of this species by some other, breeding in fresher water. The problem in fresh-water biology is a fascinating one apart from its practical interest.

P. A. B.

MISSIROLI (A.). Sulle caratteristiche termiche dei focolai di *Anopheles plumbeus*. II Nota. [**Thermal Characteristics of Breeding Places of** *A. plumbeus*.]—*Riv. di Malariologia*. Sez. I. 1935. Vol. 14. No. 6. pp. 449–456. With 3 figs. English summary (8 lines).

Following up work recorded in a previous note (this *Bulletin*, 1935, Vol. 32, p. 807) the author has studied the optimum temperature for development of larvae of *A. plumbeus* and the relations between rate of development and vitality and deduces therefrom their seasonal prevalence and area of distribution. He found that the larvae, thriving when maintained at 16°–18°C., died in a thermostat at 24°C. Comparing the breeding sites of this species with those of *A. maculipennis* he found that the daily variations of temperature of the former were very little, while those of the latter might be as much as 10° higher. On such a basis he divides anophelines into two large groups ; one whose development is favoured by a temperature nearly constant, and the other favoured by oscillating temperatures. Thus *A. m. labranchiae* develops mostly in May and June and the optimum temperatures of its breeding sites oscillate between 15° and 25°C., *A. m. elutus* prefers a somewhat higher temperature, while *A. m. typicus* develops most quickly in water subject to less wide oscillations of temperature. These facts may, he believes, play a considerable part in the seasonal prevalence of the different species. Further researches on these matters are to be made in the laboratory and in the field. *H. H. S.*

PURI (I. M.). **Schematic Table for the Identification of the Indian Anopheline Mosquitoes. Part I. Adults. Part II. Full-grown Larvae.**—*Records of the Malaria Survey of India.* 1935. Sept. Vol. 5. No. 3. pp. 265–268, with 1 folding chart; 269–273, with 1 folding chart.

Stimulated by the recent publication by TREILLARD of a combination of synoptic table and diagram, for the rapid determination of the twenty-one species of Anopheles found in Indo-China (see this *Bulletin*, 1935, Vol. 32, p. 438), the author has produced the present tables wherein similar conventional representations of diagnostic characters are employed. Unhappily, "The number of species of Anopheline mosquitoes occurring in India is . . . more than double that found in Indo-China," with the result that the postcard size, which was sufficient for TREILLARD's table, is far exceeded by Puri. Though it is stated that the chart of adults, "is mainly intended for the use of of persons working in the field," it is more than doubtful whether either table, without becoming rapidly tattered and torn, could really be so employed. Again, while not without their uses, short cuts to identification of this kind should not be regarded as final, but must needs be used with caution; that this is so is evident from the fact that in certain cases in both tables, owing to the system employed, the same characters are necessarily shown as common to more than one species or variety. *E. E. A.*

KING (W. V.) & DEL ROSARIO (F.). **The Breeding Habits of *Anopheles litoralis* and *A. indefinitus* in Salt-Water Ponds.**—*Philippine Jl. Sci.* 1935. July. Vol. 57. No. 3. pp. 329–349. With 7 plates & 2 figs.

In the Philippines, the two species mentioned in the title are those that breed in salt water, and the observations and conclusions recorded in this paper are based on collections of larvae made during twelve months in salt and brackish ponds near Manila. The range of salt concentrations affording optimum breeding conditions for *A. litoralis* differs from that preferred by *A. indefinitus*; and salt concentrations, and consequently "the abundance of the two species," are subject to seasonal influences.

A. litoralis "is predominant during the dry season, when the salt concentration is high, and is strictly a salt-water breeder, doing best in water containing upwards of about 3 per cent." Though capable, *faute de mieux*, of breeding "in brackish or even fresh water," it is believed that "the species would ultimately become eliminated at low salt concentrations." On two occasions "fairly large numbers of normally active larvae and pupae" were found in water containing 8·8 per cent. of NaCl; this was the highest salt concentration in which breeding of *A. litoralis* was met with. In the higher concentrations larvae displayed "a curious thickening or encrustation of the epidermis."

"During the rainy season *A. indefinitus* becomes the predominant species, and the breeding of this mosquito is very largely limited to brackish and fresh water." In the dry season, when the ponds were slowly evaporating, the highest salt reading for water in which larvae of this species were collected was 3·8; this was exceptional, and the degree of tolerance usually exhibited by *A. indefinitus* is considerably lower.

Floating mats of algae of several species occurred in varying salt concentrations up to 9 per cent., and were characteristic of most of the ponds in which the larvae were found. *E. E. A.*

BAISAS (F. E.). Notes on Philippine Mosquitoes, V. The Pupal Characters of Anophelines under the Myzorhynchus Series and Group Neocellia, with Further Comments on the Larvae and Adults of *sinensis*.—*Monthly Bull. Bureau of Health.* Manila. 1935. Sept. Vol. 15. No. 9. pp. 291–339. With 23 plates & 4 figs. [36 refs.]

TREILLARD (M.). Tableau synoptique pour la détermination rapide des anophèles d'Asie (régions orientale et extrême-orientale). I. Adultes.—*Bull. Soc. Path. Exot.* 1936. Mar. 11. Vol. 29. No. 3. pp. 279–282. With 1 fig.

TREILLARD (M.). Tableau synoptique pour la détermination rapide des anophèles d'Afrique (région paléarctique méditerranéenne et région aethiopienne). I. Adultes.—*Bull. Soc. Path. Exot.* 1936. Feb. 12. Vol. 29. No. 2. pp. 148–150.

MANSELL (R. A.). Cannibalism amongst Mosquito Larvae.—*Jl. Roy. Army Med. Corps.* 1936. Jan. Vol. 66. No. 1. pp. 50–51.

PIRUMOW. Die Dynamik der Malaria in S.S.R.A. [**Dynamics of Malaria in S.S.R.A.**]—*Arb. d. Tropeninstituts d. Volksgsndht. Kommissariat d. SSR. Armenien.* 1935. Vol. 2. [In Russian pp. 328–331. German summary pp. 360–363.]

Deals with the eradication of malaria in Armenia.

Following the antimalarial measures it was noted that :—the percentage of positive findings of the malaria parasite which was 48·5 per cent. in 1926 fell to 15 per cent. in 1930 and 28 per cent. in 1932.

Plasmodium vivax which was only 48·3 per cent. of all the positive findings has gradually displaced all the other varieties of malaria parasite, and rose to 81·4 per cent. in 1931 and 77·0 in 1932. *Plasmodium malariae* fell from 29·6 in the period 1924–1926 to 21 per cent. in 1931. *Plasmodium falciparum* fell from 19·2 in 1926 to 11·7 per cent. in 1932. Mixed infections showed a definite decline from 3·3 in 1926 to 1·4 per cent. in 1932.

The disappearance of malaria was not uniform in the different districts ; this was due to physical conditions, large swamps in some districts, not in others.

The eradication of malaria during the second five year plan was accomplished by an energetic and rapid reconstruction of all antimalarial measures ; drainage, inclusion of agricultural and other organizations in the affected areas in carrying out the measures, the general use of the dispensary system in town and village, the inclusion of the entire medical officials in this work, the establishment of antimalarial institutions in all the malarial areas which did not possess them, and educational propaganda. *E. D. W. Greig.*

CAUCHI (J.), BUNKALL (J. D.) & SELLERS (W.). **Mosquito Breeding in Septic Tanks.**—*West African Med. Jl.* 1935. Jan. Vol. 8. No. 3. pp. 8–9.

Culicine mosquitoes were found to be breeding in various types of septic tanks in Lagos during the month of June. The authors draw

attention to the importance of sealing the covers of such tanks, screening the fresh-air inlets, and setting up the effluent pipe in such a way that its end is under water. They found that the flushing cisterns of water-closets were dangerous as breeding-places of the yellow fever mosquito, especially when houses were empty, and the cisterns undisturbed. *W. F.*

MARTZ (F.). Les fosses septiques et les moustiques. [**Septic Tanks and Mosquitoes.**]—*Mouvement Sanitaire.* 1936. July. Vol. 13. No. 147. pp. 334–335.

The septic tank has many advantages but that it allows of development of mosquitoes is a serious disadvantage. This may occur in the anaerobic section and in the filter. Addition of oil would remedy the mosquito trouble but might interfere with the proper functioning of the tank. Discharge of the oil by the pipe on to the filter would seriously impede the action of the latter, oxidation would be prevented and the effluent would pass off unpurified. To prevent mosquito-breeding the author recommends that :—

1. The pipe discharging the fermented matter should be of large diameter and situated fairly deeply so that the upper, oily layers are not discharged.
2. The aeration tubes and those of the filter should be provided with a fine-mesh net of unoxydizable metal.
3. The joints of the plugs should be sealed with fine sand.
4. The fermentation tank should be cleaned out from time to time and the filter once a year. *H. H. S.*

MAY (Raoul Michel). L'hexachloréthane dans la lutte contre les larves de moustiques. [**Hexachlorethane as a Larvicide.**]—*C. R. Acad. Sci.* 1936. Jan. 20. Vol. 202. No. 3. pp. 246–247.

Hexachlorethane is a solid which evaporates at ordinary temperatures ; the resulting gas kills larvae and even pupae. A mixture of two-thirds hexachlorethane and one-third of talc is recommended for dusting on water. It is specially recommended for watertubs, ponds containing water for watering gardens and the like. It is harmless to man and animals. A special advantage is that the gas penetrates to the surface of water covered by weeds and algae. *W. F.*

MAY (R.). L'hexachloréthane dans la lutte contre les moustiques. [**Hexachlorethane as a Larvicide.**]—*Bull. Soc. Path. Exot.* 1936. Mar. 11. Vol. 29. No. 3. pp. 336–342.

Non-poisonous and effective, but only tested in experiments on a small scale.

Hexachlorethane (C_2Cl_6) cannot be ground up readily into a fine powder. For use, the crystals are dissolved in trichlorethylene, and one part of talc is added for every two parts of C_2Cl_6. The solvent is then allowed to evaporate and the dried powder is distributed over the surface in the same manner as Paris green. It quickly forms a gas which poisons all mosquito larvae and most of the pupae. The talc soon disappears and mosquitoes are not driven to seek new, and often

inaccessible, breeding places, as they are when oil is used. About 1 kilo is required for 100 square metres. It is not toxic for man, beasts, fishes or aquatic vegetation. *W. F.*

WANSON (M.). Note sur les trous de crabes, gîtes larvaires. [**Mosquito Breeding in Crab-Holes.**]—*Ann. Soc. Belge de Méd. Trop.* 1935. Dec. 31. Vol. 15. No. 4. pp. 575–585. With 2 figs.

Boiling water is the remedy.

Banana is a sandy peninsula below sea level at the mouth of the Congo. In the dry weather, 2,000 adult mosquitoes were caught in 330 crab-holes there. Most of them were *Aëdes* and *Culex*, but 13·20 per cent. were *A. gambiae*. In the wet weather, when the holes were flooded, larvae were found breeding in them and 26·70 per cent. were *A. gambiae*. *Aëdes aegypti* was not found. The mosquitoes bred neither in the crab-holes on the beach nor on the banks of the neighbouring creek, but only in the holes of the land crabs. No Anopheles were found breeding in water aspirated from the holes during the dry weather, though it serves as a shelter for the adults at this season. The author destroys them as follows :—Three men heat 1,600 litres of water in large metal containers, and, when it boils, they pour several litres down each hole. The crab pulls itself to pieces and dies at once. Three men can deal with more than 600 holes in a day. Diagrams of the crab-holes are given. *W. F.*

PETERSEN (Magnus C.). **Recurrence of Inoculation Malaria.**—*Jl. Amer. Med. Assoc.* 1936. Mar. 7. Vol. 106. No. 10. pp. 775–777.

Four strains of benign tertian malaria were employed in the inoculation of 261 patients. Usually the attacks stopped promptly when quinine was given, but parasites often remained in the circulation for a long time. In 14 cases parasites were found in thin smears from 6 up to 150 weeks after the fever had subsided. The average amount of quinine which had been given to these patients was 44 grams. In 6 cases a recurrence occurred after 30 weeks, or after a period which was a multiple of this. The temperature curve was more irregular in the recurrence than in the primary attack, and parasites were scarcer. It is suggested that in respect of relapses, there is little difference between blood-inoculated and mosquito-inoculated malaria.

JAMES states that the late recurrence at the seventh month does not occur after blood-inoculated malaria. *W. F.*

OSGOOD (Edwin E.). **Phagocytosis of Malaria Parasites by the Neutrophil Leukocytes of the Marrow.**—*Proc. Soc. Experim. Biol. & Med.* 1935. Nov. Vol. 33. No. 2. pp. 219–220.

Bone-marrow was obtained from the sternum in 5 cases of inoculated-tertian malaria, and, in every instance, malaria parasites were found within the neutrophile leucocytes in all stages of digestion from the intact organism to the residual collection of pigment, although there was no evidence of phagocytosis in ordinary blood films which were made at the same time, beyond the occasional presence of pigment granules within the cells. *W. F.*

CORRADETTI (Augusto). Sull'immunitá acquisita nella terzana benigna in relazione col trattamento dell'attacco primario. [**Acquired Immunity in Benign Tertian Malaria : its Relation to Treatment of the Primary Attack.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 3. pp. 161–170. With 4 charts (3 on folding plate). English summary.

The observations described in this paper were undertaken with the object of confirming an opinion expressed in the third general report of the Malaria Commission of the Health Organisation of the League of Nations. This opinion was to the effect that, from a strictly scientific point of view, no specific treatment should be given during a primary attack of benign tertian fever : the patient would then have an opportunity of acquiring a sufficient degree of immunity to prevent relapse.

Fifteen patients suffering from general paralysis were infected with a Madagascar strain of *P. vivax*, by means of anophelines. Five of these were given quinine after the first attack of fever. Five others received quinine after the fifth attack of fever, and the remaining five after the tenth attack. The temperature was taken and the blood was examined of each patient, every day, throughout a period of twelve months. The results of these examinations are set out in graphic form. They indicate that treatment of the primary attack of fever after the first access of fever does result in more frequent relapses than when the administration of quinine is delayed, and that a longer time is required to develop immunity. On the other hand the total number of attacks of fever suffered by the patient is diminished by the prompt administration of the drug. The author concludes that, from the point of view of the patient, a reduction in the number of attacks of fever is of greater importance than an acceleration in the acquisition of immunity and that, therefore, a primary attack of benign tertian malaria should be treated as soon as possible. *N. W.*

JAMES (S. P.). **Chemotherapy of Malaria.**—*Nature.* 1935. Nov. 9. Vol. 136. No. 3445. pp. 743–745.

Very little chemotherapy research is done in England owing to lack of money for this purpose.

" It has to be admitted that, despite some remarkable discoveries, existing knowledge on the prevention of malaria is not sufficient. Direct war on the malaria-carrying mosquito is too difficult and too costly for general use, and quinine has failed to maintain its old reputation as the sovereign remedy which meets all needs." In support of this conclusion, Colonel James instances the recent epidemic in Ceylon and the ineffectual attempts to combat it, the failure of antimalaria measures in Mauritius, which have cost the government more than 3½ million rupees since 1909, the even more expensive and less successful antimalaria work in Lagos and the immobilization of the English, French and German armies by malaria in the Struma valley during the war. " More knowledge is needed in many different directions, one of them being chemotherapy, in which subject British chemistry has as yet played only a very small part. This seems surprising when we reflect that, of the 3½ million deaths from malaria recorded in the world every year, the great majority occur in the British Empire, and that the British Empire alone spends every year about £450,000 on quinine. . . . It is not expected, of course, that in England funds available for chemotherapy research will ever be provided on the same scale as in Germany,

but . . . having regard to the humanitarian, economic and imperial interests at stake, it is greatly to be hoped that something will be done about it." *W. F.*

MEGAW (John). **A Simple Method of checking the Strength of Stock Mixtures of Quinine.** [Lab. Demonstration.]—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. June 30. Vol. 30. No. 1. pp. 4–5.

" The requirements are :—

" (1) Quinine test reagent consisting of pure phosphotungstic acid 1 oz., dilute sulphuric acid (B.P.) 5 oz., rectified spirit 12 oz.

" (2) Control solution of quinine of the same strength and composition as the mixture to be tested, *e.g.*, 10 grains to the ounce.

" (3) A few test tubes of equal calibre—about ⅓ inch by 3 inches.

" (4) A marked pipette to deliver about 2 cc.

" (5) A small pipette marked so as to measure 0·2 c.c.

Method.

" Put 2 c.c. of the test reagent in each of two test tubes. Add 0·2 c.c. of the control solution to one tube and mix well immediately by reversing the tube five or six times while keeping it closed. Add 0·2 c.c. of the mixture under test to the other tube, mix well immediately. Then mix the contents of both tubes simultaneously and place the tubes in a vertical position.

" If the two solutions have been treated in exactly the same way any difference in their strength will be indicated within 10 minutes by differences in the height of the supernatant liquid, and in half an hour by differences in the height of the precipitates.

" If the stock mixture is stated to be 5 grains to the ounce, the control solution must, of course, be the same and 0·4 c.c. of each of the quinine solutions must be added to the tubes containing the test reagent.

" . . . Do a few preliminary tests, first using two solutions of the same strength, and then solutions of different, but known, strengths until the technique is mastered. Note that if the quinine solution is not *immediately* mixed, after being added to the reagent, variations in the precipitate will result.

" The purity of the stock quinine powder can be tested by comparing a solution made up on the spot with a control solution made from pure quinine."

The method is not suitable for accurate quantitative estimates of the strength of mixtures. *N. W.*

STATISTICAL BULLETIN METROPOLITAN LIFE INSURANCE COMPANY. 1935. Oct. Vol. 16. No. 10. pp. 7–9.—**The Rising Menace of Malaria.**

" It is an indisputable fact that any community can now rid itself of every trace of this disease if it so desires. All that is necessary is the application of the principles laid down by General GORGAS in his work in Cuba and the Panama Canal Zone more than 30 years ago. . . . . About 97 per cent. of all malaria cases in the United States occur in the south-eastern section of the country. In each of the 13 States included in this area, there has been an alarming increase in malaria mortality since 1931. These increases have ranged from 24 per cent. in Missouri and Arkansas to 140 and 169 per cent. in Louisiana and Mississippi, respectively. . . . . In 1934, there were 4,520 deaths in the entire United States ascribed to malaria . . . a malaria prevalence of at least 900,000 cases in the United States at the present time."

[The Canal Zone is hardly " rid of every trace of the disease."] *W. F.*

CHOLERA.

VAN HUNSEL (J. H. F. E.). De uitroeiing van de cholera en de strijd tegen de pokken in Nederlandsch-Indië, met eenige epidemiologische beschouwingen betreffende in Nederland voorgekomen pokken-epidemieën. [**The Eradication of Cholera and the Campaign against Smallpox in Netherlands India.**]—*Geneesk. Bladen uit Klin. en Lab. voor de Praktijk.* 1936. 33rd Ser. No. 12. pp. 373–410 (1–38). With 2 maps. [43 refs.] [Summary appears also in *Bulletin of Hygiene.*]

In this monograph many interesting points of history and practice are considered. Of the three main tables contained in the work the first is the most interesting. In it the two diseases cholera and smallpox, with their mortality and morbidity, are set out for British India and, collectively, for Java and Madoera from 1912 to 1935. The population of British India in 1921 was 318,942,000 and of Java and Madoera 34,984,171 in 1920. We find from the table by summation that the number of deaths from cholera in British India was, during the years 1923–1934, 2,490,409, and for Java and Madoera only 17, of which 16 were in the year 1927 and one in 1928. It seems evident that the great improvement in the Netherlands Indies, as regards cholera, must be set down to the introduction of pipe water supplies, reorganization of the public health service, large scale vaccination, insistence on certificates of vaccination for immigrants and pilgrims, and strict quarantine regulations. The map given for the distribution of cholera cases in Eastern ports of 1934 is rather significant in its showing of infection in all important ports of British India, Siam, French Indo-China, China and the Philippines with complete freedom of those of Netherlands India, Australia and New Zealand. It is obvious too that consideration will have to be paid to the question how far air services may modify the present state of affairs.

In the case of smallpox a glance at the table and the map of distribution in 1934 show that this disease, although reduced to negligible proportions, has not been completely eradicated from the Netherlands Indies. Only one case seems to have occurred in Sumatra in 1934 and one in Java, a marked contrast to the 1,529 recorded for Calcutta. A most interesting reference is made to what is now past history—the development of the production of a thoroughly reliable vaccine lymph. This is especially associated with the name of NIJLAND, who maintained that any great multiplication of institutes for this purpose was quite unnecessary. Thus, whereas in Holland with a population of 5·9 million there were 12 such institutes, there was only one central institute for Java and Madoera, with a population of 30 million. The chief reason for the difference is to be found in the large yields from vaccinifers and the preservation of the lymph obtained, points to which NIJLAND paid especial attention. An indication of this yield may be obtained from OTTEN's figures of what was required for the whole of the Netherlands Indies with a population of 60 million. These are given as 4–6 rabbits, 8–12 cow calves and about 60 buffaloes. A comparatively recent development too is the preparation of a dried vaccine lymph which has high keeping qualities even in a hot tropical climate.

W. F. Harvey.

BERNARD (P. Noël). Le choléra en Indochine et en Extrême-Orient. [**Cholera in Indo-China and the Far East.**]—*Arch. Insts. Pasteur d'Indochine.* 1935. Apr. Vol. 6. No. 21. pp. 3–75. With 6 graphs & 2 maps. [114 refs.]

This is a comprehensive review of the position as regards cholera in the East. It extends in its range from British India to Japan and the Philippines and contains many interesting observations.

Cholera may be endemic, and is endemic, in India, Indo-China and China, but "India is the only part of the world where cholera has existed in a permanent fashion from the remotest times and in the same form." The emphasis here is evidently not on the endemicity but on the permanence of the presence of cholera as compared with its periodic disappearance in other countries.

In marked contrast to India, or more definitely Bengal, we have the three great archipelagoes of Japan, the Philippines and the Netherlands Indies. They are all subject to the menace of cholera and yet Japan and the Netherlands Indies have remained immune, or practically immune, from the disease. In the Philippines epidemics are more frequent and more lasting but there has been notable diminution during the past 12 years. French Indo-China is especially vulnerable to all methods of penetration of cholera—by land and by sea. The conditions too are very favourable for the extension of the disease. Thus it is not surprising that cholera has also been known in Indo-China from the remotest antiquity. The endemicity of cholera in Indo-China is referred to Cochin-China, Cambodia and Southern Annam : it does not concern Tonking, Northern Annam and Laos. Endemic cholera is liable, in these areas, to be confused with alimentary disturbance and especially the intoxications due to the *enterococcus*.

What is interesting in the Far East is the success of preventive measures against cholera in the Netherlands Indies and Japan. Take the statistics of Japan. In 1902 and 1916 there were 13,362 and 10,371 cases of cholera ; in 1917, 1918 and 1919 there were 894, 0 and 2,912 cases, and in 1932, 1933 and 1934 there were 0, 5 and 0 cases. The successful exclusion of cholera in Japan, which is menaced by China and especially by Shanghai, affords the proof that "the same means of defence have given to Japan the same results as to the frontiers of Europe."

W. F. H.

HERNANDO (Eugenio). Epidemiological Analysis of the Epidemic of Cholera in the Visayan Region during the Period from 1930 to 1934.—*Monthly Bull. Bureau of Health.* Manila. 1935. Dec. Vol. 15. No. 12. pp. 429–459 ; & 1936. Jan. Vol. 16. No. 1. pp. 3–20. With 3 maps & 2 graphs.

LOH (V. T.) & TAI (T. Y.). **A Study of the Blood in Cholera with a Note on Urine Analysis.**—*Chinese Med. Jl.* 1936. May. Vol. 50. No. 5. pp. 651–664. [16 refs.]

It is suggested in this study that the administration of large amounts of sodium chloride by intravenous injection may be harmful in cholera patients and increase the gravity of the acidosis and uraemia of the later stages of the disease. "If a patient received within two days, say fifteen litres of normal saline, it would mean that he receives 135 grams of sodium chloride, which is an enormous amount even for a patient who had lost part of it through vomiting and diarrhoea." A solution

with lower percentage of sodium chloride is recommended, of composition, sod. chloride 0·6 or 0·7 per cent., pot. chloride 0·03 per cent., calc. chloride 0·025 per cent. and glucose 2·5 per cent. The glucose acts as a diuretic. When desirable 0·5 per cent. sod. bicarbonate may be added to counteract the tendency to acidosis. If the substitution of this salt-alkali-glucose solution for the ordinary normal salt or hypertonic solution in the treatment of the dehydration of cholera is proved more beneficial, it is likely to be so in other conditions in which dehydration is a prominently grave condition. *W. F. H.*

MUSTAPHA (Ali). Action sur le lait et pouvoir cholérigène du vibrion cholérique. [**Action upon Milk and Cholera-producing Power of the Cholera Vibrio.**]—*C. R. Acad. Sci.* 1936. June 29. Vol. 202. No. 26. pp. 2188–2190.

KOCH originally laid stress upon the fact that the cholera vibrio grew well in milk and acidified it without coagulating it. This characteristic of the cholera vibrio has been somewhat neglected, and the author has investigated it anew with 64 strains of cholera vibrios—10 from India and 15 from Indo-China, which had been isolated in large epidemics, 12 from epidemics in Baghdad and Basrah of limited extent and little power of diffusion, and 27 of El Tor type. The result was that all but one of the strains from India and Indo-China grew well in milk but did not coagulate it, while the vibrios of Baghdad and Basrah, derived from feeble epidemics, did coagulate it. The ability to coagulate milk attained its maximum in the El Tor vibrios which, although apparently true cholera vibrios, do not produce cholera. Thus there may be considerable importance attachable to this criterion, which seems to distinguish between the epidemic and non-epidemic types of cholera vibrio. The more active the strain in coagulating milk the less is its cholerigenic power. *W. F. H.*

WHITE (P. Bruce). **Observations on the Polysaccharide Complex and Variants of** *Vibrio cholerae.*—*Brit. Jl. Experim. Path.* 1936. June. Vol. 17. No. 3. pp. 229–234.

Detailed evidence is offered by the author in this communication of the views expressed in previous publications (this *Bulletin*, 1934, Vol. 31, p. 895; 1936, Vol. 33, p. 374) regarding the polysaccharide structure of vibrios, which is the basis of their specificity. The S, R and ρ forms of a vibrio represent respectively degrees of degradation of the normal S form by loss of dominant polysaccharide constituents and consequent unmasking of one or other of the remaining polysaccharide elements, which becomes dominant in its turn. Four distinct groups of polysaccharide receptors, named Cα, Cβ, Cγ and Cδ, account for the serological specificity of the normal parent S form and its variants. The S form possesses Cα, Cβ, Cγ and Cδ receptors with Cα dominant, the R form Cβ, Cγ and Cδ with Cβ dominant and the ρ form Cγ and Cδ with Cδ dominant. This is the thesis presented. No variant degraded below the ρ form has yet been discovered and the polysaccharide substances contained by this form are "common in whole or in part to many vibrios." Although the polysaccharide elements of the vibrio have been thus far differentiated, it must not be assumed that they are unit substances. They may be internally complex and "the characteristic smooth receptors of the Inaba and Ogawa types of *V. cholerae* —Cα (Inaba) and Cα (Ogawa)—are almost certainly so." A

point of great importance in the recognition of these differential characters in organisms is the preparation and possession of the specifically reacting monovalent polysaccharide-precipitating sera. Thus anti-Cα sera are best prepared by intravenous injection of S vibrios, living or killed at 56°C. over a short period, and anti-Cβ sera by injection of R vibrios under the same conditions, while anti-Cδ sera have been usually obtained by inoculation of rabbits with living ρ vibrios. " No direct and certain method has been found of obtaining a monovalent anti-Cγ serum. A monovalent anti-Cγ serum can, however, be obtained, as is the case with the other monovalent specific sera, by saturation methods. In this way Cγ serum can be obtained from a mixed Cγ-Cδ serum by saturation with Cδ polysaccharide.

The separation of the Cα, Cβ, Cγ and Cδ factors is a matter largely of chemical fractionation methods and the use of the differential action of papain. Thus the digestion of cholera vibrios with papain in faintly acid medium will result in solution of the Cα and Cγ constituents only : the undissolved Cβ and Cδ can then be obtained from the residue with alkali.

It is not contended that the ultimate fractions of the vibrios are entirely pure substances. They may be " contaminated with inactive material." Not only so, but the extension of the term " polysaccharide " to the four substances named may possibly be a misnomer. There are two main fractions, I and II, obtained in the course of the chemical manipulations and these are—in the case of the cholera vibrio—each derived from S, R and ρ forms. The results of precipitation reactions of monovalent anti-S (Cα), anti-R (Cρ), anti-ρ (Cγ) and anti-ρ (Cδ) sera upon fractions I and II, with their several special treated portions, form the basis of the argumentation developed in this article.

The application of these methods to the various agglutination types of vibrio has now been begun. " It will suffice to say here that the true El Tor vibrio presents a polysaccharide complex serologically identical with that of *V. cholerae* (of the same absorption type) ; that the Cγ and Cδ factors seem to be common, so far as can be judged by simple precipitation tests, to all the types of vibrio so far examined ; that different groups of vibrios show sharp differences in the behaviour of their Cβ substances ; and that the Cα substances determine the serological specificity of the various smooth types." *W. F. H.*

i. HEIBERG (Børge). **The Biochemical Reactions of Vibrios.**—*Jl. Hygiene.* 1936. Feb. Vol. 36. No. 1. pp. 114–117.

ii. ——. **Two Serologically Different Groups among the True Cholera Vibrios.**—*Ibid.* pp. 118–124.

i. In the main the first of these two articles is controversial and makes reference to GARDNER and VENKATRAMAN's expression of qualified doubt as to " the possibility of an accurate biochemical classification " of the vibrio group. According to Heiberg it is " possible to distinguish six different types of fermentation in vibrios " by the use of only three sugars, mannose, saccharose and arabinose. The most important of his groups, the type I, with fermentation manifested in mannose and saccharose but not in arabinose, contained 287 out of 384 test strains of vibrios collected at random. With the exception of the vibrio " Dunbar " all the strains in this group agglutinated with an anti-cholera serum. All the strains, however, showing a variation in fermentation from this type I, that is to say the types II to VI, except

vibrio "Dunbar," differed from the true cholera vibrios not only serologically but also biochemically. The conclusion therefore to be drawn is that "any vibrio, not fermenting according to type I, has no (or hardly any) O-antigen common to the true classical cholera vibrios (Gardner and Venkatraman O-group I).

ii. The second article treats of a subdivision of true cholera vibrios into "a large group with the common factor A alone and a smaller group with one factor more (B) in addition to the common factor A." This separation of groups has been effected by using cross-absorption tests as well as cross-agglutination. Both the antigens A and B are thermostable somatic antigens. "This finding may be of importance in epidemiological investigations and in the preparation of vaccines."

W. F. H.

Korobkova (E.). Observations ultérieures sur la cytologie des vibrions cholériques. [**Cytology of the Cholera Vibrio.**]—*Rev. Microbiol., Epidémiol. et Parasit.* 1936. Vol. 15. No. 1. [In Russian pp. 13–20. With 3 figs. French summary pp. 20–22.]

The demonstration of the presence of a nucleus in bacteria has occupied the attention of many workers. Recent researches into variation and microbial dissociation have renewed the interest in this matter. According to the author distinct nuclei can be shown in bacteria but only at a certain stage of development and this stage is very fleeting. Great variation can be observed in cholera vibrios grown in starch media and one of the variations is the production of nucleated forms and also of giant nucleated forms. A good medium to use is one of horse bouillon with 0·5 per cent. Witte peptone, 0·5 per cent. salt, 18 per cent. starch and pH 7·6. Cholera vibrios of 5–6 days are sown in this medium, incubated at 38–39°C. for 48 hours and maintained at 10–12°C. for 48 hours. Such a culture provides beautiful nucleated forms from the 5th day. "These nucleated elements are attached to certain colonies of type O which under the action of lytic principle dissociate into S forms." The O stage is only temporary and may be missed. By suitable conditions of cultivation the O phase may be prolonged and nucleated forms obtained with greater regularity.

W. F. H.

Aida (T.). Ueber die im Sommer 1934 in Shanghai als Cholerabazillus isolierte Vibrio.—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. Apr. Vol. 35. No. 4 (373). [In Japanese pp. 766–776. [45 refs.] German summary p. 777.]

Sugio (K.) & Shimomura (H.). **The Studies on Agglutination and Agglutinin Absorption Test of B. cholera.**—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. Feb. Vol. 35. No. 2 (371). [In Japanese pp. 518–533. English summary p. 534.]

Three results emerge from this study of the value of agglutination and absorption tests for the identification of the cholera vibrio. They are that :—(1) Cholera vibrios when killed, whether by heat or formalin, show great variability in specific agglutination reactions, whereas these remain definite and constant when living vibrios are used. (2) Vibrios grown on nutrient media of lower pH are more agglutinable and have higher absorptive power than when grown on a more alkaline medium,

although the latter is more favourable to growth itself. (3) The higher the pH of the menstruum in which the vibrios are suspended for agglutination tests, the more rapidly is the reaction completed.

These points should all be taken into consideration in applying tests.

W. F. H.

SCHOLTENS (R. Th.). Analyse des récepteurs du vibrion cholérique. [**Receptors of the Cholera Vibrio.**]—*Ann. Inst. Pasteur.* 1936. June. Vol. 56. No. 6. pp. 710–716.

In a previous work (this *Bulletin*, 1936, Vol. 33, p. 376) it was shown that the cholera vibrio possessed two thermostable antigenic receptors A′ and B′ capable of giving rise to agglutinins A and B. Most strains possess only the receptor A′ but a few possess both A′ and B′. It was interesting then to determine whether sera possessing only agglutinin A and those possessing both A and B reacted in a differential manner when amboceptors were concerned, as in the deviation of complement test and also how these sera behaved in absorption tests. Experiments were carried out to this end and the conclusions come to were :—(1) The antigen B′ and its antibody B do play a part in the reaction of deviation of complement and this action may be even more important than that of A′ and A. (2) Strains possessing both A′ and B′ do not absorb the agglutinin A so well as the strains which have only the receptor A′. (3) It seems advisable to incorporate both antigens A′ and B′ in anticholera vaccines. *W. F. H.*

VASSILIADIS (P. Ch.). Action du chloroforme sur les agglutinations flagellaire " H " et somatique " O " des vibrions, et mutations sérologiques de ces antigènes. [**Action of Chloroform on Flagellar H and Somatic O Agglutination of Vibrios and Serological Mutations of these Antigens.**]—*Jl. Egyptian Med. Assoc.* 1936. May. Vol. 19. No. 5. pp. 247–283. [21 refs.]

Chloroform is a solvent of fats and it would seem that it dissolves a lipoid necessary for O agglutination. Its action in the case of H agglutination may be the removal of a lipoid inhibiting this type of agglutination. Some of the results obtained by the author were :—(1) Chloroform extraction considerably reduces the O agglutinability of vibrios by specific serum. (2) The thermostable antigen O, which is rendered almost inagglutinable by chloroform, is not destroyed, for it is still capable of acting as antigen in animal injection and also in absorption of O agglutinin. (3) Chloroform extraction considerably increases the H agglutinability of vibrios and may even cause an H agglutination in non-agglutinable vibrios. (4) Mutations of agglutinability were observed in three vibrios El-Tor of 1935. (5) Two vibrios, non-agglutinable at the time of their isolation at El-Tor in 1935, became agglutinable later. *W. F. H.*

VASSILIADIS (P. Ch.). Modifications de l'agglutination somatique O et flagellaire H des vibrions après traitement par le chloroforme. [**Modification of Somatic O and Flagellar H Agglutination of Vibrios by Chloroform.**]—*C. R. Soc. Biol.* 1936. Vol. 121. No. 11. pp. 1069–1071.

Extraction of vibrios by chloroform (1) lowers considerably their somatic O agglutinability : (2) increases very markedly the H flagellar

agglutinability of cholera vibrios ; (3) causes to appear a flagellar H agglutinability of considerable titre in vibrios which are not agglutinable as such by HO anticholera serum. *W. F. H.*

YANG (Y. N.), TSAO (S. L.), CHANG (Y.) & CHUNG (C. Y.). The Bactericidal Action and Agglutinin Response of Persons Inoculated with Typhoid and Cholera Vaccines.—*Chinese Med. Jl.* 1936. Feb. Supp. No. 1. pp. 202-212.

GHOSH (H). **Further Investigation of a New Anti-Cholera Serum.**—*Brit. Med. Jl.* 1936. May 9. pp. 936–938.

In this modification of the author's original method a much larger quantity of seed culture is used for inoculation of the special broth than in the case of manufacture of the original toxin (this *Bulletin*, 1933, Vol. 30, p. 538). The toxin obtained is used to immunize serum horses. In the trials now made only whole immune serum was given, in one intraperitoneal dose of 70 to 80 cc. diluted with 200 cc. warm salt solution, instead of concentrated serum as on the previous occasion (this *Bulletin*, 1935, Vol. 32, p. 459). Altogether 47 cases were treated with a mortality of 10·63 per cent. as against 170 control cases treated by other methods with a mortality of 20·5 per cent. Uraemia, it is noted, was absent in the serum treated cases and this is regarded as " an indication of the neutralizing effect of the serum on the toxin, which could not therefore cause any further damage to the kidney." Tympanitis too was rarely observed. Only two patients out of the 47 showed a mild urticaria. *W. F. H.*

PASRICHA (C. L.), DE MONTE (A. J. H.) & GUPTA (S. K.). **A New Type of Choleraphage—Type M.**—*Indian Med. Gaz.* 1936. Apr. Vol. 71. No. 4. pp. 194–196. With 1 fig.

The addition of a twelfth type of choleraphage to those already existing is made by the authors an occasion for very interesting remarks on the choleraphage question. A new choleraphage, type M, has been isolated, which is slow acting, gives an incomplete lysis in liquid medium, acts on both rough and smooth vibrios and has a very wide range of activity. All types of choleraphage possess one common characteristic in that they have " reciprocal " action ; " the secondary culture obtained after the action of any one type is lysable by the remaining types of choleraphages." All of these phages act on " ultrapure " cholera vibrios, but vary in the effects they produce singly or combined. Perhaps the most interesting of these phages is the type A, which acts only on agglutinable vibrios possessing a considerable amount of smooth element. Again " type A antiphage serum inhibits only type A choleraphage, whereas the other types appear to be related serologically." All the other choleraphage types, B to M, lyse a certain number of inagglutinable vibrios. Transformation of vibrios from one strain to another, or even one species to another, is a subject of constant controversy. This subject is closely related to the phage question, for alteration of the antigenic structure of an organism, as of smooth to rough or the reverse and of agglutinable to inagglutinable, can be brought about by phage action. Pasricha and his co-workers have dealt also with vibriophages in general as distinct from purely choleraphages. This distinction is made by defining vibriophages as those " which are active on inagglutinable vibrios and which if active on inagglutinable

vibrios do not give the reciprocal cross test." Under the influence of certain vibriophages some strains of inagglutinable vibrios become agglutinable and indistinguishable from true cholera vibrios. Thus it is certain that in the present-day studies of vibrios special attention must be paid to the rôle of the choleraphage and the bacteriophage in effecting what seems to be a transmutation. *W. F. H.*

PASRICHA (C. L.), DE MONTE (A. J. H.) & O'FLYNN (E. G.). **Bacteriophage in the Treatment of Cholera.**—*Indian Med. Gaz.* 1936. Feb. Vol. 71. No. 2. pp. 61–68. With 1 graph. [16 refs.]

A serious and very commendable attempt has been made, by the authors of the trials here described, to assess the therapeutic value of bacteriophage in cholera on an alternate case basis. The criterion of the fatal issue, which has the advantage of being definite and incontrovertible, is the one employed. An immediate difference is apparent between the old mortality statistics of 8·1 per cent. for the phage-treated cases and 62·9 per cent. for the untreated and the present series. In this present series 1,369 cases of cholera were admitted to hospital. "Of these, 684 cases were treated with specially prepared choleraphage and 685 were not treated with choleraphage." This division into two groups was made by admitting patients alternately into two separate wards. The mortality figures now became 13·5 per cent. for the phage-treated and 16·6 per cent. for the non-treated. It is admitted that the results have not been dramatic and that the authors "have not met with the striking results obtained by some of the previous workers." No analysis has been attempted of the age distribution or severity distribution in the two groups of trial cases on admission to hospital but some analysis has been made of the severity of the disease as it evolved. This latter analysis has tended to accentuate the value of treatment by phage in modifying the course of cholera favourably. Other analyses are of the presence of agglutinable vibrios or inagglutinable vibrios in the stools and the absence of vibrios. The mortality figures show up much more favourably, as between treated and untreated, when agglutinable vribios only were found. One difficulty, or rather supposition, is mentioned as militating against the strictly alternate character of the groups involved and that is the possibility of spread of bacteriophage from the ward of untreated cases to the ward of treated cases. This, it has always been maintained by D'HERELLE, vitiates all such trials. An interesting fact is also brought out which, not being easily explainable, is meanwhile left out of account. This was that the relative mortality rates as between phage-treated and non-treated are reversed altogether when only inagglutinable or no vibrios were isolated, for now it is the non phage-treated patients who show more favourable results. Nevertheless there was no reason to suppose that cases in which no vibrios could be found were not cholera cases.

All circumstances having been taken into account, the authors reach a well argued conclusion from a scientifically planned trial when they say :—"Comparison of the results of the experiment, taking recovery or death as the sole criterion of the value of choleraphage, shows that bacteriophage has caused a real reduction in cholera mortality in cases passing vibrios and that this reduction is more marked in those cases passing agglutinable vibrios." *W. F. H.*

RAYNAL (J.). Rapport de mission aux Indes Anglaises relative à l'étude des bactériophages appliqués à la prévention du choléra (Août-Septembre 1933). [**Report on the Mission to British India for the Study of Bacteriophage Prophylaxis against Cholera.**]—*Arch. Insts. Pasteur d'Indochine.* 1935. Apr. Vol. 6. No. 21. pp. 77–126. With 1 map & 15 figs. [Refs. in footnotes.]

The mission referred to here had as its object "the study at the bacteriological laboratory of Shillong . . . of the technique of preparation of bacteriophages and their application to the prevention of cholera." The report is very full on the subject of technique and non-committal on the subject of claims for success of bacteriophage prophylaxis or therapy (see this *Bulletin*, 1935, Vol. 32, p. 460). *W. F. H.*

DZEN (M. Y.) & YU (H.). **The Optimum Dosage of Prophylactic Cholera Vaccine.**—*Chinese Med. Jl.* 1936. Feb. Supp. No. 1. pp. 198–201.

Arrangements for mass prophylactic inoculation with any vaccine may demand a special procedure. In the case of the municipalities of Shanghai and other centres in China it has not as a rule been possible to administer more than a single dose. This and the fact that the immunity induced is short lived constitute the difficulties of the situation. At the same time the dangerous season for cholera epidemics in China is a short one and "confined to a few weeks during the summer season." Thus it becomes important to determine the single optimum dose of vaccine which will be most effective under these circumstances. The authors realized that actual protection tests were even better than agglutination response for this purpose and used very considerable numbers of guineapigs in their experiments. These experiments involved injection of the prophylactic subcutaneously and a testing dose two weeks later of 5 cc. of a 16-hour broth culture of *V. cholerae.* They obtained, for concentrations of sterilized vaccine of 2,000, 4,000 and 8,000 million per cc. and the use of 124, 42 and 122 guineapigs respectively, percentage mortalities of 41·94, 22·50 and 20·49. The control group of unvaccinated guineapigs, 75 in number, gave a mortality of 68·66 per cent. It was therefore evident that "the more highly concentrated vaccine is undoubtedly the most effective." A further experiment with a system of vaccination by two injections of 1 cc., each containing 2,000 million organisms, gave only one death out of 42 guineapigs. The conclusions drawn are that (1) where possible two injections are better than one, and (2) if only one is possible the concentration should be raised from 2,000 million to 4,000 or 8,000 per cc. *W. F. H.*

TEWARI (M.). **A Secondary Reaction after Anti-Cholera Inoculation.** [Correspondence.]—*Lancet.* 1936. Mar. 7. p. 572.

——. **Late Reactions after Anti-Cholera Inoculation.** [Correspondence.]—*Indian Med. Gaz.* 1936. Apr. Vol. 71. No. 4. p. 242.

This is a record and a request for an explanation of the occurrence of a secondary reaction to inoculation of cholera vaccine. It occurred in about 8 to 10 per cent. of persons inoculated, on the 12th to 14th day and took the form of localized redness, pain and tenderness with rise of temperature. As a reaction it was milder than the primary. *W. F. H.*

PLAGUE.

QUARTERLY BULLETIN OF THE HEALTH ORGANISATION. LEAGUE OF NATIONS. Geneva. 1936. Mar. Vol. 5. No. 1. pp. 89–109. —**Plague.** [Report of Committee on Plague and Resolutions of Pan-African Health Conference, Johannesburg, Nov. 20–30, 1935, pp. 89–95.] THORNTON (Edward N.). **Position in Regard to Plague in the Union of South Africa** [Annex I. pp. 96–102.]. GIRARD (G.). **The Plague in Madagascar, and the New Knowledge gained from Research during the Last Three Years** [Annex II. pp. 103–107]. RIBEIRO (L.). **Developments in Endemic Plague in Angola from 1932 Onwards** [Annex III. pp. 108–109].

I. Points of interest and importance taken from this report are :— (1) " In the Union of South Africa and countries grouped immediately to the north and west of it, the incidence of human plague is determined by the epizootic among wild rodents, infection being in great part direct from wild rodents, and to a less extent from domestic rats infected by fleas from wild rodents." (2) In the more northern territories there is evidence of an increasing importance of the domestic rat. (3) Epizootics may have been in progress for some time before they are discovered. It is manifest that close observation of the habits of wild rodents and of the clues which afford evidence that an unusual death rate is occurring, is necessary if early discovery of the epizootic is to be made. (4) Resolutions were adopted :—

(*a*) " That the best practical policy for towns is to concentrate on the systematic building out of rats, and to supplement it by effective rodent destruction, plus the creation of deep rodent-free belts around boundaries, rather than to rely on such measures as mass prophylactic inoculation. (*b*) That, in countries where spread is mainly by wild rodents, the setting up and maintenance of barriers by gassing, poisoning and trapping plus an attack on domestic rodents, is strongly to be recommended in every case. (*c*) That, in countries where the domestic rodent problem is an important factor and where it defies control, prophylactic vaccination may have to be undertaken, in addition to such anti-rodent measures as are practicable."

II. Salient points regarding the history of plague in South Africa are well summarized as follows :—

" (1) From 1892 to 1905, plague was introduced at the ports and caused extensive outbreaks amongst domestic rodents and a considerable number of human cases in urban areas before it was eradicated from these areas. (2) From 1903 to 1905 striped mice (*Rhabdomys pumilio*) in the bush surrounding one or more of the ports became infected, and the infection spread slowly through the bush until it reached, in 1914, sandy country inland, where gerbilles were plentiful, when rapid spread all over the inland parts of the Union with isolated human cases occurred. (3) During the period 1914–1933, human cases were almost entirely infected from veld rodents, and domestic rodents were found infected in exceptional cases only. (4) During 1934-35, with the breeding up of veld rodents owing to favourable seasons, numerous waves of infection occurred, resulting in an increased number of human cases. Further, domestic rodents became infected in a considerable number of places. (5) The indications for the coming season are that cases of plague will again show an increase, owing to the fact that gerbille colonies have again multiplied enormously in the neighbourhood of former foci."

III. The position in Madagascar differs from that in South Africa, for there is no evidence here suggesting that wild rodents are concerned

in the transmission of plague to the rat or that they are a reservoir of plague. "The rat constitutes the animal reservoir which keeps the disease going." And yet it is the bush land of the high plateaux which furnished the greater number of plague cases. The chief plague problem is a rural one. Another point of importance which has been emphasized is that *X. cheopis*, the rat flea, is quite frequently found free of the rat in the dust of native houses, especially in the dark corners where temperature and humidity are constant. Moreover, fleas have been shown to be plague-infected "in huts in which a case of human plague occurred and in which no rats could be found." A new plague-carrying flea, *Synopsylla fonquernii*, has been identified on rats of the high plateaux, but only in the outside burrows, "Where *X. cheopis* never occurs."

In Madagascar a living attenuated plague vaccine has been used in man on a large scale. It is claimed that by its use the death rate from plague has been reduced by two-thirds and the general death rate from all causes by 50 per cent.

The possibilities of serum therapy have also received attention and the same living attenuated plague strain has been used, up to large doses, for the inoculation of the horses which provide immune plague serum. Doses are reached of two full Roux flasks of culture by intravenous injection.

IV. This is a short report dealing with the endemic manifestations of plague in Angola which have occurred since the end of 1932.

W. F. Harvey.

THORNTON (E. N.). **Plague.**—*Rep. Dept. Public Health South Africa 1934–35.* pp. 29–34. 1935. Pretoria. [Summarized in *Rev. Applied Entom.* Ser. B. 1936. Apr. Vol. 24. Pt. 4. pp. 76–77.]

"An epizootic of plague occurred among veldt rodents and in certain localities the incidence in man was high. Owing to the large amount of rat-proofing that has been carried out, urban centres were little affected. In the Orange Free State, where the disease was most prevalent, the summer of 1933–34 had been particularly favourable for the growth of the grasses on the seeds of which gerbilles feed and an enormous increase occurred among these rodents. In November 1934 waves of plague were reported to be destroying them, and the likelihood of domestic rodents becoming infected and so bringing about the infection of man was forecast. The incidence in man was highest in the south-western part of the Orange Free State where the Namaqua gerbille [*Desmodillus auricularis*] is abundant and the lobengula gerbille [*Tatera lobengulae*] is also found. The relative freedom of the northern part of the State may be attributed to the extensive destruction of veldt rodents in that area during the previous epizootic. The number of farms infected was very small compared to the extent of the epizootic, and this was probably due to the relative freedom of domestic rodents from infection. The chief intermediary between the gerbilles and man was the multimammate mouse [*Mastomys coucha*], although in a few instances *Mus* (*Rattus*) *rattus* was also involved. The floors of huts that could not be economically fumigated were dusted with calcium cyanide (cyanodust) and subsequently flamed with a blow lamp. Calcium cyanide in the form of calcid briquettes applied to rodent burrows by means of a rotary duster gave promising results."

TSURUMI (M.). L'épidémie de peste du Mandchoukouo en 1934. [**Epidemic Plague in Manchukuo in 1934.**]—*Bull. Office Internat. d'Hyg. Publique.* 1936. Feb. Vol. 28. No. 2. pp. 263–264.

Two regions were involved in this epidemic, Nungan and the railway line. A total of 898 cases of plague was distributed over 94 villages, which was about half the number of the previous year. The disease was entirely bubonic in form, while septicaemia and pneumonia were secondary. Not one of the 45,464 rats examined bacteriologically was found to be plague-infected, but in 36 cases a plague-like bacillus was found in the rodent *Citellus mongolicus ramosus*, Thomas. This rodent is considered as probably responsible for the propagation of plague in Mongolia and Manchuria. *W. F. H.*

PARREIRAS (Decio). Notas e estudos sobre a peste no nordeste do Brasil, problema nacional.—*Bol. Oficina Sanitaria Panamericana.* 1936. May. Vol. 15. No. 5. pp. 429–433.

WU LIEN-TEH, CHUN (J. W. H.), POLLITZER (R.) & WU (C. Y.). **Plague : a Manual for Medical and Public Health Workers.**

This book was reviewed on p. 726.

GREY (J. C. P.). **The Control of Plague in Java.**—*Malayan Med. Jl.* 1936. June. Vol. 11. No. 2. pp. 115–116.

The views of an outside observer on the important special measures of plague control which have been adopted in thickly populated Java are particularly valuable. Measures which have been tried and failed are isolation, fumigation, rat poisoning, prophylactic vaccine. Stress is now laid on the improvement of the houses of the people who live in the country districts with a view to breaking down " the close association between man and rat." That association is not so close in the towns. The officers of the Plague Control Service themselves " take no particular precautions against the disease," as it is considered that they are only at any appreciable risk in the course of their work, if they happen to " live and sleep (especially on bamboo beds) in the epidemic area."

The Javan house is built of bamboo posts, thatch (attap) roofs and is double walled. Improvement of such a house consists in replacing bamboo—including the bamboo of beds—with timber, the roof with tiles and closing the double space between the walls. When this is done the rats leave the houses " for more congenial breeding places." Unfortunately the process of improvement of the dwelling house is costly and the people are poor. Government loans are needed and are given to the householder. It is the owner who dismantles his own house and reconstructs it " with the help and advice of the officers." The reconstructed houses are inspected, passed and again re-inspected at intervals " to ensure they are properly maintained." The success of these measures is evident. Plague started in East Java, spread to Mid Java and is now in West Java. Reconstruction of houses naturally followed the same course. It can be shown that East Java is now practically free of plague, plague is disappearing from Central Java and the same thing is happening in those parts of Western Java where the kampongs have been reconstructed. With the reconstruction the houses become brighter and cleaner ; the populace likewise seems to reflect in their lives this brightening up of their homes. *W. F. H.*

FOURIE (L.). **Field Work against Plague.**—*Proc. Transvaal Mine Med. Officers' Assoc.* 1936. Jan. Vol. 15. No. 171. pp. 43–58. With 24 figs.

The observations recorded in this paper have reference largely to the epidemiology of plague in the Eastern Cape Province, Orange Free State and Transvaal. Most of the human outbreaks have been restricted to the country districts and have affected natives much more than Europeans. They have been associated with mortality among domestic rodents resulting from an epizootic among gerbilles, with the multimammate mouse, *Mastomys coucha*, as the only agent of transmission from gerbilles to man. Although all the small indigenous species are susceptible to plague it is only the gerbille and the multimammate mouse which are important in the spread of plague. Two members of the gerbille family *Taterona* and *Desmodillus* are those concerned. The multimammate mouse is not an active animal and does not burrow to any great extent. It has acquired the habit of freely entering and taking up its abode specially in native dwellings and in outhouses but is very seldom carried in farm produce. "Being essentially a wild rodent . . . it is not found in towns . . . but only on their outskirts." Thus it can be understood why outbreaks occur in farms, and affect mostly natives, but do not occur in towns and villages. Human plague in towns is due rather to accidental infection by rats. It would be a disaster if plague spread to the rats in the Reef mines and became enzootic among them.

An intimate knowledge of the habits and behaviour of the gerbille is required for the early detection of the prevalence of a plague epizootic among them. *W. F. H.*

MEYER (K. F.) & EDDIE (B.). **Selvatic Plague in California. Discussion of its Extent in the Years 1934 and 1935.**—Reprinted from *California & Western Med.* 1935. Dec. Vol. 43. No. 6. 18 pp. [15 refs.]

Much useful commentary and discussion of selvatic plague or, as the authors insist it should be called, sylvatic plague, is contained in this pamphlet. The points raised are deserving of close attention and study. It has to be realized that in the Pacific States of the Union wild rodents play the most important rôle as reservoirs of the disease. "Only two (possibly three) human cases of plague have been recognized in 1934 and none in 1935." At intervals, however, epidemics have appeared among one or other of the wild rodents found in certain counties and it is now probable that this undue mortality has been a plague mortality. Such epidemics among squirrels and wild rabbits have previously been too readily ascribed to tularaemia and therefore not to have required systematic investigation. It is now known, of course, that many other rodents than the rat and mouse suffer from spontaneous plague. In South Africa nineteen different rodents have been found to be spontaneously plague infected. Sylvatic plague with all its possibilities has become of the greatest importance and may at any time become a grave danger to man. "Thus sylvatic plague has crossed the Pacific States and has appeared in the Rocky Mountain States. How far it has travelled in an easterly direction has not as yet been determined."

Two important observations are placed on record by the authors, one as to the fact that chronic latent plague may occur in man, and the other as to the probability that the "inapparent plague, or a *B. pestis*

infection without visible lesions," which has been established for the rat, the suslik and the tarbagan may occur in the Oregon squirrel. The physiological inactivity of these animals during hibernation may be an important factor in the determination of latency of a plague infection.

It is evident from this and other similar studies that the widespread existence of sylvatic plague demands careful investigation of the rodent species involved, their habits of life, their migrations, their hibernation, their ectoparasites and their natural enemies. The serum reactions of rodents may furnish valuable information, as also may experiments to determine the comparative susceptibility of the various species. [See this *Bulletin*, 1934, Vol. 31, p. 878.] *W. F. H.*

FENJUK (B.) & DEMJASHEV (M.). **Studies on the Migrations of Gerbilles by Means of Banding Method.**—*Rev. Microbiol., Epidémiol. et Parasit.* 1936. Vol. 15. No. 1. [In Russian pp. 89–106. With 8 figs. [37 refs.] English summary pp. 107–108.]

An attempt was made to determine how far gerbilles migrate from their burrows. This was done by catching the animals, marking them, setting them free and recatching them. Out of a total of 1,361 gerbilles 210 with marks were caught. It was established that they might wander to a distance of 100 metres from their burrows for feeding purposes and that the track left by an animal in snow or sand might extend in 24 hours to as much as one kilometre. *W. F. H.*

KALABUCHOV (N.) & RAEVSKY (W.). **The Life Cycle of the Ground-Squirrel (*Citellus pygmaeus* Pall.) and the Laws of Development of the Plague Epizootic. IV. Ecological Peculiarities of the Ground-Squirrel at the Different Periods of its Yearly Life Cycle.**—*Rev. Microbiol., Epidémiol. et Parasit.* 1936. Vol. 15. No. 1. [In Russian pp. 109–129. With 7 figs. [14 refs.] English summary p. 130.]

When newly-born squirrels appear above ground and disperse they come to occupy fresh burrows, some inhabited and some deserted. By their occupation of an old burrow the young animals may become infected through fleas left behind in nests where ground squirrels had died in an epizootic of the previous year. This dispersion of young animals therefore is the principal cause of annual epizootic outbreak and it will occur earlier or later in spring according to the climatic conditions of the locality. During the summer ground squirrels move only to short distances of a few hundred metres but the annual dispersion of young animals may lead to their travelling as much as 2–5 kilometres.

W. F. H.

TUMANSKY (V. M.). Ueber den Beginn spontaner Pestepizootien unter Zieseln, *Citellus pygmaeus* Pall., und ihren Verlauf. [**The Beginning of Spontaneous Plague Epizootics among Ziesels and their Course.**]—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 419–424. German summary p. 424.]

It is generally accepted that plague epizootics among ziesels, *Citellus pygmaeus*, Pall., begin at the time of migration of the young animals. These observations tend to show, however, that ziesels may become infected soon after their awakening from winter sleep and, apparently,

at the time of mating. There is reason to believe that the early spring epizootics do not last long owing to the short duration of the mating season, after which these animals betake themselves to an individual mode of life. The epizootic is extinguished only to light up again on the second occasion of contact, which is the migration period of the young animals. At this time the epizootic is of longer duration and lasts up to the time of hibernation. *W. F. H.*

BUXTON (P. A.). **Breeding Rates of Domestic Rats trapped in Lagos, Nigeria, and Certain Other Countries.**—Reprinted from *Jl. Animal Ecology.* 1936. May. Vol. 5. No. 1. pp. 53–66. With 2 figs. [23 refs.]

Increased attention is at the present time being paid to biological data among the animals capable of transmitting disease to man. The usefulness of such data has been abundantly proved for wild rodents and forms the basis of rational preventive measures and epidemiology. In this article a strong case is made out for more careful investigation of the domestic rodent and its fertility is the main subject of discussion. A careful analysis of data already accumulated shows that there is a seasonal rhythm for pregnancies in every country for which the figures are available. "Generally speaking the breeding season appears to coincide with the warm season in temperate and subtemperate climates. But it appears that in places which have a monsoon . . . the relation between climate and breeding is not so simple. It seems probable . . . that breeding is largely a matter of nutrition; that may well depend on harvests and indirectly on climatic events."

Due and proper emphasis is laid, in the discussion, upon the statistical pitfall of selection for the collector of field data. The samples taken may not be truly random and the deductions based upon them may lead to wholly erroneous ideas "on the existing sex ratios or figures about pregnancy or the abundance of young rats. Young rats are more easy to trap than old ones and trapping may also be selective in respect of sex." Dilution is also the source of much error in many statistical findings. The amount of breeding which is going on may, for example, be obscured by the incursion of a large population of new-born animals, none of which is yet ready to breed. These will nevertheless dilute the totals on which percentages are calculated. Some standardization, at least of age, would be required to avoid the dilution of the new-born. In fact the usual statistical presentations of age, sex and other distributions, with controls, ought to accompany all field and laboratory data. These data, too, are apt to be meagre in other respects. Even the information which is available is not always utilized; we may have given us only an average figure or percentage, or, at most, these along with a maximum and minimum, instead of the much more useful frequency distribution, mean, range and standard deviation. Types of card for the booking of data derived from each captured rat are given, which might well be made use of as standard by the plague worker. *W. F. H.*

BONEBAKKER (A.). Over pest. Symptomen, verpleging en behandeling. [**Plague Symptoms, Nursing and Treatment.**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1936. June 9. Vol. 76. No. 23. pp. 1410–1423.

As this is a clinical lecture, much of it is taken up with the description of two cases of plague. Clinically, plague may be difficult to

distinguish from typhus. In plague a marked leucocytosis, which may reach 50,000 or over with a shift to the left, is of some value in doubtful cases. It is the blood culture, however, and especially the preliminary culture in bile, which is a great standby for diagnosis. It seldom fails. Of the complications of plague the most important are those affecting the lungs—bronchitis, bronchopneumonia and lobar pneumonia. Pneumonias, both in bubonic and septicaemic plague, can make a sudden appearance, a matter of considerable importance in the nursing of plague cases. Other complications are conjunctivitis—which may lead to keratitis, iridocyclitis and hypopyon-carbuncles and other pustular conditions. Among the less frequent complications are paralyses, meningitis-like symptoms, arthritis, diarrhoea and jaundice.

The nursing staff in attendance on plague cases should wear a simple mouth and nose mask of 4-fold gauze. It should also be a practice, in feeding a patient, to stand well behind him.

Treatment of plague is largely symptomatic. The author has used bacteriophage daily by intravenous injection and, in the case of bubonic plague, has injected 2 cc. on 4 to 5 consecutive days into the bubo. His impression is that this treatment was advantageous.

W. F. H.

Le Gall, Seyberlich & Brault. Peste septicémique à évolution anormale : guérison. [**Abnormal Plague Septicaemia : Cure.**]—*Bull. Soc. Path. Exot.* 1936. Mar. 11. Vol. 29. No. 3. pp. 351–353.

On admission to hospital the patient, whose daughter was already in hospital with bubonic plague, had a temperature of 38·5°C. On the next day his complaint was of some dyspepsia, a swollen and painful abdomen, violent headache and muscular pain in the lower limbs. His temperature was 39·2°C., his general condition excellent and there was no evidence of lymph node involvement. An examination of the blood showed malarial parasites. Treatment by quinine produced no improvement. A blood culture carried out on the third day gave a positive result for plague, which was fully confirmed by animal inoculation. Treatment consisted of a daily subcutaneous inoculation of antiplague serum and a fixation abscess. The serum treatment continued until the 13th day and the patient received altogether 320 cc. Recovery took place, which is an exceptional result, but is on record for septicaemic plague. In the discussion which followed it was pointed out that, even if delicate bacteriological tests were capable of demonstrating the presence of some bacilli in the blood, this did not mean a septicaemia in which the organisms were growing freely in the blood, as is the case in anthrax or in the terminal phase of plague. A few germs can be present in the blood without constituting a breakdown in the defence of the body. It is demonstrable, for example, in diseases like typhoid, pneumonia and tuberculosis.

W. F. H.

Joltrain (E.). Cas de peste bénigne observés dans la région parisienne. Difficultés du diagnostic.—*Bull. Acad. Méd. Roumanie.* Paris. 1936. Vol. 1. No. 3. pp. 339–349.

Bodet (H.). Note sur un cas de charbon pesteux.—*Bull. Soc. Path. Exot.* 1936. Mar. 11. Vol. 29. No. 3. pp. 345–346.

MADISON (R. R.). **Fibrinolytic Specificity of** *B. pestis.*—*Proc. Soc. Experim. Biol. & Med.* 1936. Apr. Vol. 34. No. 3. pp. 301–302.

With a plasma blood clot test it had been found that only streptococci and staphylococci produced a fibrinolytic enzyme. As, however, a negative result of test may be due to the presence in a plasma clot of neutralizing bodies the present investigation was carried through with a serum-free fibrin-clot technique. It has been found that, " in addition to certain pyogenic cocci all locally available strains of *B. pestis* are strongly fibrinolytic particularly when tested with rat or guinea-pig fibrin." *W. F. H.*

FADDEEVA (T.) & TSCHERNOBAEW (W.). *Bacillus pestis* **in Mixed Culture. I. The Antagonism of Different Species of Bacteria relatively [to the growth of]** *B. pestis.*—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 346–356. With 9 figs. on 2 plates. English summary pp. 357–358.]

A number of organisms have been examined in regard to their behaviour towards the growth of *Past. pestis.* Some are antagonistic and some tend to grow in symbiosis. Among the antagonistic organisms are found *Streptococcus mucosus*, the pneumococcus, nearly all the typho-coli group, *Bact. faecalis alkaligenes*, one strain of *Chromobact. prodigiosum*, one strain of *Ps. pyocyanea*, *V. cholerae* and *B. mesentericus.* Of the organisms which could grow in symbiosis may be mentioned *Sarcina*, *Staphylococcus aureus*, *V. paracholerae*, *Bact. ozaenae*, *Bact. aromaticum* and *B. subtilis.* Dysentery organisms seem to divide themselves between the two groups, nor does the grouping appear to proceed on very well defined generic lines.

W. F. H.

SAMSONOW (Th.). Ueber den Einfluss einiger Histolysate auf das Wachstum des *B. pestis.* [**The Influence of some Organ Lysates on the Growth of** *Past. pestis.*]—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 359–364. With 5 figs. German summary pp. 364–365.]

Lysates were prepared from liver and spleen, which contained (*a*) peptone, (*b*) peptone and traces of deuteroalbumoses, (*c*) abiuretic products. One of these was added to Martin's agar in concentrations varying from 1–100 to 1–1,000,000. In the small concentrations the quality of the agar was distinctly improved for growth of *Past. pestis*, which could also be grown from a weak suspension, such as gave no growth at all on ordinary agar. The modified agar was capable of being heated and cooled without affecting its nutrient quality and could be preserved for 3 months. *W. F. H.*

MORALES OTERO (P.). The Bacteriology of Plague. A Review.—*Puerto Rico Jl. Public Health & Trop. Med.* 1936. Mar. Vol. 11. No. 3. pp. 553–583. [83 refs.] [Spanish version pp. 584–616.]

DEVIGNAT (R.). Note sur une méthode pratique de recherche de l'infection pesteuse chez les rongeurs.—*Ann. Soc. Belge de Méd. Trop.* 1936. Mar. 31. Vol. 16. No. 1. pp. 43–45.

POKROWSKAJA (M.). Ueber prophylaktische Impfungen gegen Pest. [**Prophylactic Inoculation against Plague with Avirulent Living Organisms.**]—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 376–385. With 1 chart. [10 refs.] German summary pp. 385–386.]

An avirulent culture of the plague bacillus was obtained as a mutant from the action of bacteriophage on a virulent strain. This culture was tested for its immunizing properties on ziesels and guineapigs and gave mortality rates of 10 or 11 per cent. in the inoculated animals as against 80 or 100 per cent. in the controls. *W. F. H.*

SOKHEY (S. S.) with the technical collaboration of H. MAURICE. Un nouveau sérum antipesteux. [**A New Antiplague Serum.**]—*Bull. Office Internat. d'Hyg. Publique.* 1936. June. Vol. 28. No. 6. pp. 1097–1100.

The new antiplague serum is obtained by the immunization of horses. To begin with the horses are inoculated intravenously with avirulent cultures and later with virulent cultures and filtrates of cultures of 4 weeks in bouillon grown at 27°C. A special method of testing the efficacy of the serum is used and is based on the author's quantitative method of standardization of plague antigen (this *Bulletin*, 1936, Vol. 33, p. 367). It consists of using graduated doses of the test serum and injecting each of these doses into a group of 5 mice of about 3 months' age. The mice receive subcutaneously on the other side the standard infecting dose of plague bacilli, 0·5 cc. 1–1,000,000 dilution of a 48-hr. bouillon plague culture of standard virulence. That dose of serum which saves more than half of the animals injected is taken to be the protective dose. By this method of measurement the protective dose in cc. was found to be :—new serum 0·05, buffalo serum of Naidu 0·3, Pasteur Institute serum 0·5 and Lister Institute serum 0·5. In previous trials of plague serum therapeutically it had been found that, once bacillaemia was established, it was quite ineffective. In order to test this point for the new serum a technique has been devised, based on the observation that mice receiving subcutaneously the standard injecting dose developed bacillaemia in about 72 hours with 100 per cent. mortality in 5 to 9 days. Such mice, commencing treatment at 72 hours with 0·9 cc. new serum subcutaneously, given in 3 daily doses of 0·3 cc. each, showed a saving of 70 to 80 per cent. of the test animals. A small series of human cases gave 3 deaths out of 17 for the new serum and 13 deaths out of 17 controls. *W. F. H.*

IWANOWSKY (N.) & FADDEEVA (T.). Einwirkung des Chloroforms auf das Antipestserum. [**Action of Chloroform on Antiplague Serum.**]—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 404–409. With 2 figs. [10 refs.] German summary p. 410.]

The action of chloroform on the protein constituents of antiplague sera was determined by shaking the two up together. The following conclusions are drawn :—(1) Precipitation, mainly of the globulin fraction, takes place. (2) The rate of precipitation depends on the amount of chloroform added and the duration of the shaking. (3) The precipitation brought about by shaking with chloroform is an adsorption phenomenon and is correlated with the presence of emulsifying

substances. (4) In the process the titre of the antibodies, agglutinins and precipitins, diminishes at a rate which is parallel to the loss of globulin. *W. F. H.*

SOUKNEV (V.), JOUKOW-WEREJNIKOW (N.), FAWORISSOWA (B.) & KASANZEVA (E.). **Combined Treatment of Plague with Bacteriophage and Envelope, Paris and Nucleoproteid Anti-Sera.**—*Rev. Microbiol., Epidémiol. et Parasit.* 1935. Vol. 14. No. 4. [In Russian pp. 387–392. [12 refs.] English summary p. 392.]

In these experiments the various sera were injected simultaneously with the testing dose of plague bacilli. The Paris serum, obtained by immunization of horses with living plague organisms, prolonged the life of test animals on the average to 23·67 days, the nucleoproteid serum to 7·6 days, the anti-envelope serum to 9·4 days and the bacteriophage to 4 days. Control animals lived for 4 days. The best results were obtained by combining bacteriophage with an antiserum, where the former acts as a vaccine under the protection of the passive immunity given by the latter. *W. F. H.*

KURAUCHI (K.) & HOMMA (H.). Nouveau vaccin antipesteux purifié et concentré et titrage de son efficacité. Recherches sur la fraction antigène spécifique du bacille de la peste. [**New Concentrated Plague Vaccine, its Efficacy. Specific Antigenic Fraction of the Plague Bacillus.**]—*Bull. Office Internat. d'Hyg. Publique.* 1936. June. Vol. 28. No. 6. pp. 1088–1096.

According to the authors of this note the plague bacillus contains two independent antigens one of which is contained in the capsule and the other in the body of the organism. It is the antigen of the capsule which is specific and efficacious in producing immunity (S.I.F. or "specific immunizing fraction"). The antigenic protein of the body is not efficacious and only contributes to producing an unwanted reaction. If immunization with a single dose is desired it is necessary to use the S.I.F. solution absorbed by metallic salts and in the form of an emulsion. Used in this way the vaccine develops less secondary reaction because absorption is slowed. Titration of a test S.I.F. vaccine is effected by means of a comparison with the flocculation occurring between a standard dried solution of S.I.F. and the homologous antiserum. One unit of this vaccine signifies the quantity of S.I.F. corresponding to 1 mgm. of bacillary substance cultivated at 37°C. and about 20 units are sufficient for immunization in man. *W. F. H.*

GIRARD (G.) & ROBIC (J.). La vaccination de l'homme contre la peste au moyen de bacilles vivants (virus vaccin E.V.). Son application à Madagascar. [**Plague Vaccination of Man with living Bacilli.**]—*Bull. Office Internat. d'Hyg. Publique.* 1936. June. Vol. 28. No. 6. pp. 1077–1087.

Notices of the use of E.V. vaccine have appeared in this *Bulletin* (1935, Vol. 32, p. 850, and 1936, Vol. 33, p. 366). The strain used in preparation is avirulent for the guineapig and rabbit by subcutaneous and other injection. Intraperitoneally it may be lethal in large doses. All guineapigs vaccinated with this living strain have withstood very severe tests, corresponding to thousands of fatal doses and to the test of infected *X. cheopis*, which killed a control guineapig in 5 days. The

large scale vaccinations carried out in human beings have already been referred to and the conclusion is now drawn that :—" The mortality from plague has been reduced by two-thirds in the vaccinated as compared with the controls and the general mortality from all causes by 50 per cent." It is to be noted also that, (*a*) not a case of primary or secondary pneumonia has occurred in the vaccinated as against 17 among the controls, and (*b*) septicaemia has been much less apparent in the vaccinated than in the controls dead of plague. *W. F. H.*

LONG (J. D.). **Choice of Rat Poison in Antiplague Work. Rat Poisons used by the National Antiplague Services of Ecuador, Peru, Chile, and the Argentine Republic.**—*Public Health Rep.* 1936. May 1. Vol. 51. No. 18. pp. 551–554. Also in *Bol. Oficina Sanitaria Panamericana.* 1936. June. Vol. 15. No. 6. pp. 519–522.

The " prime requisite " in a rat poison is that it should be slow in action to permit of the rats leaving the spot where it has been eaten, carrying their fleas with them and dying, as is their habit, in an inaccessible place as remote as possible from either rat or human contact. Such a poison is to be found in commercial arsenic. Methods of deratization by poisoning are only temporary, but may have to be adopted and frequently repeated by communities too poor or too scattered to employ " ratproofing and other antiplague measures of more permanent value." Change of type of poison bait before rats become used to it, its generous use and careful distribution are some of the essentials of a satisfactory poisoning campaign. Formulae of some of the poisons used are :—(1) *Poison packets* :—coarsely ground corn meal 35 ; cheap wheat flour 35 ; grated cheese, ground dried fish, dried blood, finely ground dried meat or finely ground peanuts 15 ; commercial arsenic 15. Put up in paper packets containing one teaspoonful. (2) *Fish poison* :—Cheap fresh fish without bones 85 ; commercial arsenic 15. Spread as paste on bread, banana leaf, paper or shavings and place near rat runs. (3) *Fresh blood poison* :—Fresh blood from the slaughterhouse boiled down to a jelly 60 ; barley flour or meal, wheat flour, finely ground corn meal or ground salt fish, to give consistency, 25 ; commercial arsenic 15. Spread as in the case of fish poison.

Few accidents have occurred, considering that in Guayaquil, Ecuador, 17,691 pounds of poison packets and over 40,000 pounds of fish poison were used. " The use of the poison packets has caused the death of chickens, some domestic animals, such as cats and dogs, and occasionally a burrow (ass). . . . One child was poisoned." This child ate 10 packets ; his brother, who ate 6 packets, did not die. " The amount of arsenic in a single packet is just about sufficient to kill an animal the size and weight of a rat." *W. F. H.*

YACOB (M.). **A Note on the Use of Cyanogas " A " Dust as a Raticide and Pulicide.**—*Indian Med. Gaz.* 1936. June. Vol. 71. No. 6. pp. 336–338. With 1 fig.

The chief advantage of cyanogas over the " *bhoosa-battis* " commonly used for smoking out rat-holes in the Punjab is that it penetrates much better. It can destroy both rats and fleas at a distance of 15 feet, whereas the *bhoosa-battis* does not reach to more than 10 feet for rats

and 5 feet for rat fleas. Moreover "about one-eighth of all the *bhoosa-battis* soon become extinguished after the rat holes are closed with mud" and therefore fail in their object. Perhaps the chief disadvantage of the cyanogas is the element of danger in its use. This is, however, small with a competent staff. *W. F. H.*

PEIRCE (E. R.). Mesures adoptées contre les rats à Liverpool. [**Anti-Rat Measures at Liverpool.**]—*Bull. Office Internat. d'Hyg. Publique.* 1936. June. Vol. 28. No. 6. pp. 1119–1128.

These measures are given in great detail and will repay direct consultation in the original communication. *W. F. H.*

LEESON (H. S.). **Further Experiments upon the Longevity of** *Xenopsylla cheopis* **Roths. (Siphonaptera).** — *Parasitology.* 1936. July. Vol. 28. No. 3. pp. 403–409. With 3 figs.

Previous experiments were carried out on unfed fleas (this *Bulletin*, 1932, Vol. 29, p. 839) and, contrary to the view of BACOT and MARTIN, it was then found that "there is no direct proportion between survival of unfed fleas and saturation deficiency of the atmosphere at any temperature." In the present series of experiments the fleas were fed before being starved and the same result emerged, that "there was no direct proportion between survival times and saturation deficiency." It was found that "fleas fed once before starvation lived longer than unfed fleas and fleas kept with the host for 7 days before starvation survived still longer." *W. F. H.*

SASSUCHIN (D.), IOFF (I.) & TIFLOW (W.). Materials for the Study on the Parasites and Enemies of Fleas.—*Rev. Microbiol., Epidémiol. et Parasit.* 1936. Vol. 15. No. 1. [In Russian pp. 27–44. With 15 figs. [52 refs.] English summary p. 44.]

REVIEWS AND NOTICES.

FEDERATED MALAY STATES. **Annual Report of the Institute for Medical Research for the Year 1935** [KINGSBURY (A. Neave), Director].—pp. vi+126. 1936. Kuala Lumpur: Govt. Printer. [50 *cts.* or 1*s.* 2*d.*]

In spite of the absence on long leave during the last three-quarters of the year of the heads of four divisions of the Institute, and the persistence of "depression-level" funds, this report records much valuable research and no diminution of routine work, the demands for vaccine-lymph having been exceptionally heavy.

Drs. J. W. FIELD and J. C. NIVEN are making a comparative study of the therapeutic efficiency of Atebrin musonate, Atebrin and Quinine bihydrochloride. Daily parasite counts, the duration of fever and the numbers of re-admissions to hospital are given. The urinary excretion of the drugs has also been followed daily: atebrin has been detected continuously up to the 41st day after a 7-day course totalling 2·1 gm.: it has been found in the urine within 10 minutes of intramuscular injection of the musonate and within 90 minutes after oral administration. Up to the end of the year 583 cases of acute malaria had been treated. "The findings indicate that atebrin musonate is a valuable drug, particularly perhaps in benign tertian infections, though severe nervous symptoms, following treatment, have been noted in two sub-tertian cases."

A year's extensive comparative field trial of atebrin and quinine in prophylactic use was commenced in September by the same officers in collaboration with the Malaria Commission of the League of Nations. The figures suggested that "up to the end of 1935 atebrin had been relatively effective," while those obtained with quinine had been better than expected. Interesting findings can also be expected from concurrent anopheline surveys commenced by Mr. G. H. CORBETT.

Continuation of the Selangor Coast Survey resulted in the taking of nearly 6,000 anophelines, of which some 4,500 were dissected. Out of 980 specimens of *A. barbirostris* trapped in one area 11 were found infected. Certain chemical examinations were undertaken of 159 samples of water in which larvae were taken. *A. hyrcanus* var. *sinensis* and *A. vagus* were often found associated with salt-water species such as *A. sundaicus*.

Notification of an impending change in the diesel oil to be supplied for M.D.B. (Mosquito Destruction Board) mixture, has necessitated further laboratory and field experiments.

A laboratory investigation of spray compared with spray-brush methods of anti-larval oiling showed little difference in the efficiency of "disturbed" spray brush and "undisturbed" spray oil.

The blood of each of 16 specimens of the Malayan Flying-fox was found to be infected with a plasmodium: infection was attempted without success of over 100 mosquitoes of several different anopheline and culicine species, nor did infection follow injection of the bat's blood into three different species of monkey and a loris.

A decrease has been noted in the incidence of tropical typhus on certain oil-palm estates, after they have been in bearing for some years. The decrease is not easily explained. More infections have occurred on rubber estates.

Further progress is recorded in researches by Drs. R. LEWTHWAITE and S. R. SAVOOR in tropical typhus. [See also this *Bulletin*, 1936, Vol. 33, pp. 424 ; 433.]

The outstanding finding of the year has been noted to be the experimental carriage of rural " K " virus by *Xenopsylla cheopis*. After the original difficulties in maintaining the " K " virus in guineapigs, and the strain had become well established, passage through fleas seems to have caused a reversion to the type of early passage " K " virus. Bodies morphologically resembling *R. orientalis* have occasionally been seen within the nuclei of endothelial cells of the peritoneum and its exudate (mammalian tissue), recalling such bodies as those described by WOLBACH in epithelial cells of the gut, hypoderm and salivary glands of ticks infested with Rocky Mountain Spotted Fever virus.

Peritoneal exudate is a regular feature of " K " virus lesions in the guineapig and has been found to contain 10,000 to 100,000 Minimal Infective Doses per 1 cc., while anterior chamber fluid of the eye of infected rabbits may contain 70 to 300 M.I.D. for the guineapig. Numerous attempts have been made to utilize these exudates in the production of a prophylactic vaccine, with hopeful results from a few experiments using peritoneal exudate.

Other points in regard to typhus research include :—

(i) Successful storage of " K " virus in peritoneal exudate for 11 days at 0° to —5°C.

(ii) Staining of *R. orientalis*.

(iii) Protective value of human convalescent serum.

(iv) Immunization commenced of a horse against " K "/Japanese River Fever virus.

(v) Skin reaction following intracutaneous inoculation of " K " virus.

The Vegetable Oil Section of the United Planting Association of Malaya is making a contribution towards the cost of a rat-virus enquiry; poisoning and other methods of rat destruction may also be considered.

An attempt is being made to popularize the local use of palm oil in human dietary. Dr. J. A. SIMPSON is therefore undertaking an investigation of its carotene content in connexion with the refining required prior to human consumption. The oil is expected to be a valuable source of energy and by virtue of its carotene content it may be regarded as an indirect source of vitamin A.

Medico-legal requests for the determination of blood groups from blood stains have led Dr. J. A. CHELLIAH to investigate under local conditions various possible techniques and the effect of age on the stain. Experimentally agglutinins were detected in saline extracts from fairly large stains for a week or two, and by a test of absorption of agglutinins from normal Group O serum by scrapings of the stain positive results were obtained even after 9 months.

After prolonged investigation with the Hortvet cryoscope of the freezing point of the milk of local cows and buffaloes, Dr. J. A. SIMPSON has been able to establish the test as a valuable additional method of detecting added water.

Other general points dealt with include :—

(1) the keeping qualities of a sample of dried insulin : no deterioration was found over 6 months at room temperature.

(2) racial distribution of blood groups ;

(3) effect of the Mohammedan fasting month on carbohydrate metabolism ; on healthy young adults no alteration of the glucose tolerance curve was detected ;
(4) Friedman's modification of the Zondek Ascheim Test : 11 successful tests.
(5) Weekly complement fixation tests by a pooled stock of Wassermann positive serum, in dilutions from 1/10–1/160, as an additional check on the standardization of complement.

The visits of Dr. V. B. WIGGLESWORTH towards the end of 1934 and of Dr. J. J. C. BUCKLEY during 1935, both from the London School of Hygiene and Tropical Medicine, have been greatly appreciated. Dr. Buckley has tentatively identified the cercariae, which appear to cause a special dermatitis, "Sawah itch" among rice-field workers, as of *Schistosoma spindalis*, a parasite of bovines. *P. H. Martin.*

ROCKEFELLER FOUNDATION. **Annual Report 1935** [MASON (Max), President].—pp. xv+479. With 20 plates. New York : 49 West 49th Street.

That part of the Annual Report for 1935 of the Rockefeller Foundation which refers to Public Health and Medical Science is a record of work of which the Foundation may justifiably be proud. The President, Members and Officers consider that the Rockefeller Foundation has, by now, sufficiently demonstrated, in many countries, the feasibility of the control of diseases by local health organizations; in future it can render the best service by carrying out research, both in the field and in the laboratory, which will lead to the acquisition of new facts, and a more effective and economical method of control.

In the report for 1934, an account was given of several outbreaks of yellow fever, in districts in South America, where *Aëdes aegypti* is not found. In 1935, many cases of this "jungle yellow fever" were discovered in Goyaz and other parts of South Central Brazil, an area of over one hundred thousand square miles, from which the disease had never been reported previously. Jungle yellow fever occurs in open country, but not in the towns. Both clinically and pathologically it is identical with urban yellow fever, and produces the same lesions in mice and monkeys. The mode of transmission to man is not known. Much work was done in 1935 in the Rockefeller laboratories in New York, on possible methods of immunization against yellow fever. In order to attenuate the virulence of the virus, it was grown in tissue cultures, but it was not considered safe to use it alone ; it was therefore given with immune serum. As the supply of the latter from human sources is very limited, human vaccination was found to be impracticable on a large scale. The serum of immune goats was tried, but gave unpleasant reactions ; with the immune serum of monkeys much better results were obtained, and this method is being tested in Brazil.

At Fiumicino, in Italy, anti-mosquito work has been very successful. In 1926, when the work was begun, over 5,000 anophelines were caught at certain fixed stations ; in each of the three years, 1933, 1934 and 1935, only one specimen was taken at the same places ; and the number of dispensary malaria cases fell progressively from about a hundred to only two in 1935. Active malarial measures are also being carried out in Albania, Portugal and elsewhere.

The prevalence of tuberculosis is being investigated at several places in the United States, in Jamaica and Austria ; and special attention

is directed to the incidence of the disease in the same family, and to the relationship between tuberculosis occurring in childhood, and subsequently in the adult.

A survey was made of the distribution of yaws in Jamaica, where the disease and its treatment were the subjects of intensive study. Flies of the genus *Hippelates* were found to be capable of conveying yaws from man to the rabbit. These small flies often hover about the eyes, and have been suspected, for a long time, of causing severe conjunctivitis in man ; in both cases, the part that they play is probably a mechanical one.

Substantial grants were made for the furtherance and improvement of public health nursing in several countries, and nearly two hundred fellowships in public health were given.

During 1935, a little more than half of the Foundation's expenditure on medical science was devoted to the advancement of psychiatry, including clinical neurology, anatomy, physiology and pathology of the nervous system, and some aspects of psychology. Contributions were made to certain schools for training and research in these subjects, and fellowships were given to well-qualified workers in this field.

The subjects mentioned above are only a few of those dealt with in the Report ; as usual, the whole of it is of much interest, and merits careful study. *H. J. Walton.*

NOCHT (Bernhard) [Dr. Med., Dr. Med. H. C., Hamburg] & MAYER (Martin) [Dr. Med., Dr. Med. Vet. H. C., Hamburg]. **Die Malaria. Eine Einführung in ihre Klinik, Parasitologie und Bekämpfung.** [Malaria ; its Symptomatology, Parasitology and Control.] 2nd Enlarged Edition.—pp. iv+172. With 24 figs. & 2 coloured plates. 1936. Berlin : Verlag von Julius Springer. [Rm.15·60].

This is the second edition of a book published originally in 1918. It is based on lectures given to army doctors and medical men proceeding to the tropics. The book contains a good, and practical account of malaria on the usual lines ; as much of it is necessarily rather elementary, there is little scope for originality, but it is thoroughly accurate, and represents quite adequately the present state of knowledge of most aspects of the subject.

A large proportion of the space is given to treatment, and this is particularly well discussed. The pathogenesis and treatment of blackwater fever are also considered at some length, and useful advice is given about the treatment of malaria in patients who have withstood an attack of blackwater fever. The pathology of malaria, antimalarial measures, mosquitoes and their control, are disposed of rather summarily.

The authors state that the book is not intended to be a complete treatise on malaria, but a guide to the subject for non-specialist practitioners ; there is no doubt that they have attained their object, and more. *H. J. Walton.*

FOSSEN (Arie). **Over maligne halslymphkliergezwellen.** [Malignant Tumours of the Cervical Glands.] [Thesis for Doctorate of Medicine, Medical High School, Batavia.]—102 pp. With 7 figs. on 3 plates & 1 chart. [56 refs.] 1936. Batavia-C. Kolff & Co.

This is a doctorate thesis on a condition which is by no means uncommon in Java and Sumatra. Malignant growth of the glands of the

neck is seen among Chinese and Malays alike. Some are lymphosarcomata, some reticuloendotheliomata, others what have been described by ROULET as retothelsarcomata. The two latter arise in the reticulo-endothelial elements of the glands, but by special staining methods reticulin is shown to be present in the latter, absent from the former. Whether this is to be ascribed to different grades of anaplasia or explained by the theory that the reticulo-endotheliomata arise in the germinal centres of the follicular part of the glands which are also practically devoid of reticulin is not yet decided.

Again, these neck tumours may be secondary, *i.e.*, metastases from buccal or nasopharyngeal growths, occurring early before the primary has been recognized. The author has borne this in mind and in his cases examined these cavities post-mortem when he had opportunity and found that so many patients dying from these tumours of the neck had no signs of any primary growth elsewhere that he believes most of them to be cases of primary gland tumours. A painstaking piece of work. *H. H. S.*

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